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THE UNIVERSITY OF ALBERTA

BEAVER ECOLOGY/BEAVER MYTHOLOGY

BY

R. GRACE MORGAN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND
RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF ANTHROPOLOGY

EDMONTON, ALBERTA

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled The Beaver: Sacred Cow of the Northern Plains submitted by R. Grace Morgan in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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C. Hickey ....

Date: April 2/91

Upon recommendation of the examination committee the thesis title has been changed to:

BEAVER ECOLOGY/BEAVER MYTHOLOGY

TO MY CHILDREN

BRIAN, JERRY, MICHAEL AND KIM

ABSTRACT

The advent of the fur trade brought into focus the aversion of several Northern Plains tribes to beaver hunting. A paucity of beaver remains in the archaeological record suggests that this aversion may be very ancient. Indian myths and rituals associated with beaver medicine bundles imply a cultural reinforcement against the killing of beaver. The main hypothesis states that the aversion to hunting beaver by Plains occupants was a response to the limited availability of surface water, and a recognition of the beaver's role in maintaining these resources in the Valley Complex (river/stream) systems. An underlying premise in this study has been that hunter/gatherers are aware of basic ecological relationships; and these forms of knowledge are an important part of resource procurement strategies.

On the Plains, beaver populations conserve and stabilize surface water in select habitats, which are most frequently found on large tributaries. The Plains peoples also preferred the large tributaries for their wintering areas. Within these areas beaver maintain surface water, and by felling tree/shrub species provide firewood and construction materials. During drought beaver ponds become a crucial source of water. Given the above and the fact that beaver populations are low, the Plains groups refrained from beaver hunting. In contrast,in the Woodlands, beaver are abundant and in earlier times provided an important source of food; however, these same beaver activities resulted in flooding with detrimental consequences to the resident Woodlands groups. The destruction of browse/grass areas not only reduced the food sources of large game animals, but effectively dispersed them. Through the creation of beaver meadows and the use of prescribed fire, the Woodlands groups were able to both control beaver populations, and provide grass/browse areas that attracted and concentrated the large game animals-an important source of food.

On the Plains,the archaeological evidence from the valleys of the different size confirmed that the large tributaries were the preferred areas for winter campsites.

Historical documentation implies that the aversion to beaver hunting reached its highest expression in the groups that entered the Plains as a pedestrian peoples: the Blackfoot tribes (Piegan, Blood and Blackfoot proper), the Gros Ventre, and the Plains Assiniboine. Within the framework of the fur trade, beaver hunters,e.g., Woodland Cree and Assiniboine, were given preferential status. Because they traded less valuable furs, many Plains groups were unable to buy a sufficient supply of guns and ammunition. As a result, several tribes (the Piegan and Gros Ventre) not only suffered military defeats, but territorial realignments occurred which were to their disadvantage. Several factors eventually brought about an erosion of the aversion to beaver hunting: economic pressures; intensifying tribal animosities; a dependence upon alcohol ;and a weakening of the environmental basis (largely the result of the acquisition of the horse) underlying the non-use of beaver.

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2

CHAPTER I

INTRODUCTION

In the historic period the fur trade brought into focus the aversion of several Northern Plains tribes to the beaver hunting. A paucity of beaver remains in the archaeological record of this region suggests that the origins of this aversion may be very ancient.

Fur traders were quite emphatic in their complaints about the above aversion, and its detrimental effects on their trading returns. Alexander Henry notes that, "Beaver are numerous, but they [Blackfeet] will not hunt them with any spirit, so that their principal produce is dried provisions, buffalo robes, wolves, foxes and other meadow skins, and furs of little value" (in Coues 1965:529-30). John McDonnell, a North West Company trader, stated that:

> The Assiniboils of the Red [Assiniboine] River are ...the worst hunters of any Indians in the North-West who have traders amongst them. Their whole hunt consists of wolves, foxes, kitts and buffalo robes; for beavers, otters and other good furs they seldom take any (in Masson 1960:Vol.I:281).

Alexander Mackenzie (1802:45) similarly distinguished the Assiniboine as non-beaver hunters and, as well, the Fall Indians [Gros Ventre]. While in charge of a North West Company post on the North Saskatchewan, Umfreville (1954) also observed the reluctance to beaver hunting in the above mentioned groups; but was particularly adamant about its negative influence on the Susee [Sarsi], complaining that:

> These Indians are lazy and improvident; they bring us very few peltries, and those ill drest. Wolves skins are their chief commodity (1954:103).

McGillivray, who was in charge of Fort George (a North West Company post) on the North Saskatchewan River, grouped the non-beaver hunters under the category *Gens du large*, including the Blackfeet, Gros Ventres, Blood Indians, and Piegans, which, compared to the Beaver Hunters, he observed, "... are treated with less liberality, their commodities being chiefly Horses, Wolves, Fat & Pounded meat which are not sought after with such eagerness as the Beaver" (in Morton 1929:31).

Ethnographers such as Secoy (1953), Curtis (1970), and Ewers (1958), as well as the historian Morton (1973), have also pointed out this behaviour pattern among various Plains groups. Ewers has also stressed the fact that the non-use of beaver resources did not appear to be a response to a scarcity of said resource, noting:

> If the traders anticipated a rich harvest of beaver in the Blackfoot trade, they were soon disillusioned. There were plenty of beaver in the creeks and rivers. A good hunter could have killed a hundred of them a month with his bow and arrows.... the Blackfeet were generally not beaver hunters (1958:32).

Alexander Mackenzie has pointed out a geographical and/or environmental distinction between beaver and non-beaver hunters.

> Of all these different tribes, those who inhabit the broken country on the North-West side, and the source of the North branch [the Saskatchewan], are beaver-hunters; the others deal in provisions, wolf, buffalo, and fox skins; and many people on the South branch do not trouble themselves to come near the trading establishments (1802:49).

Ethnohistorical documentation by Morton (1973) and Nelson (1973) has also led them to point out this broad geographical distinction with regard to beaver hunting. Nelson also claims that these differences in attitudes to beaver affected the relationships the Indians developed with the fur trade. He concluded that:

> ...the Indians of the North became dependent on the trader much more quickly than the people of the plains. One reason was their lack of any apparent phobia against the hunting of riverine animals (1973:188).

These environmental differences (Plains versus Woodlands) have brought about intra-tribal distinctions with regard to beaver hunting, strongly evident among the Assiniboine since contact. Ray (1976:11) notes that in 1685 the Assiniboine were recognized as one of the primary suppliers of furs to the Ottawa Indian-French trading system. He observed that the above contacts were made in the eastern margin of their territory; more specifically, they were located in the Rainy Lake region. However, as early as 1739-40 Joseph La France (in Dobbs 1967:35), during his explorations in the interior, had already distinguished the "Assiniboine of the Meadows" from the "Assiniboine of the Woods". Also during this time period (1738) La Verendrye, while travelling through the parklands, was informed by a group of Cree "...that we were going among people [Assiniboine] who did not know how to kill beaver, and whose only clothing was buffalo skin, a thing we did not require" (in Burpee 1927:301). It is therefore highly likely that the Assiniboine referred to by Ray were from the Woodland division. It should be noted that the earlier references to the non-use of beaver by Assiniboine reflected the behaviour of those occupying the Plains. Both divisions were observed to trade at Fort George on the North Saskatchewan, the Strong Wood Assiniboine being the beaver hunters (Morton 1929:34).

Although the Blackfoot nation as a whole manifested the strongest aversion to the hunting of beaver, a similar dichotomy of beaver and non-beaver hunters was found among the Piegan. Again the distinguishing factor referenced was a contrast in environmental conditions. Henry observed that:

> There are 30 or 40 tents [Piegans] who seldom resort to the plains... This small band generally inhabit the thick wood country along the foot of the mountains, where they kill a few beavers, and being industrious, they are of course better provided for than those Piegans who dwell in the Plains. The latter despise labor, and will not kill a beaver or any other fur animal to enable them to purchase an axe or other European utensil, though beaver are numerous in every stream throughout their country (in Coues 1965:723-24).

There is also documentation to suggest that several groups acquired the aversion to beaver hunting as they moved onto the Plains during the historic period. Henry comments that the Sarcee, before they moved from the north side of the Saskatchewan to the south side, "... were excellent beaver hunters... but from intercourse with the Slaves [Blackfoot] have become fully as lazy and indolent" (in Coues 1965:737). The same phenomenon was observed by Henry among the Cree:

> Those only who frequent the strong wood country can purchase liquor and tobacco. Those who inhabit the plains are a useless set of lazy fellows... Buffalo is their only object. Although passionately fond of liquor and tobacco, still they will not resort to the woods where they could procure furs to purchase those articles (in Coues 1965:512-513).

The archaeological record for the northwestern Plains also supports a non-utilization of beaver resources. At several Saskatchewan sites, e.g., the Garratt site (Morgan 1979), the Long Creek site (Wettlaufer and Mayer-Oakes 1960), and the Lebret site (Smith 1986), the extremely low frequencies of beaver remains suggest minimal use of this resource or none at all. The faunal analyses of seven archaeological sites excavated in the Bighorn Canyon of Montana and Wyoming revealed no evidence of beaver (Husted 1969). The analysis of faunal remains from approximately 20 sites ranging from the Early to the Late Prehistoric period, and located predominantly in the northwestern Plains, yielded beaver in only one site (Mulloy 1958).

Some attempts have been made to explain the perceived aversion to beaver hunting. While travelling with a group of Indians, mainly Blackfoot and Piegan, Fidler's comment, upon observing their lack of experience in beaver hunting, was that "... several of them are so full of superstition as even not to touch one and a great many of them will neither eat of them nor suffer one of them to be brought to their tents" (in Nelson 1973:171). Ewers (1958:32) implies that among the Blackfeet the non-hunting of beaver may relate to its being considered a sacred animal. In a similar vein, Richard Lancaster's (1966:188) Blackfoot informant in Montana stated that the reason the Blackfoot never trapped beaver on a commercial basis was because of a religious prohibition against trapping underwater Persons of which the Beaver Persons were the leaders.

It could be asked that if religious prohibitions were the only causal basis for the non-hunting of beaver, then why did they not transcend the environmental conditions that have been the distinguishing factor in their expression? The religious prohibitions are clearly related to ecological factors, given the differences in beliefs and practices between the Plains and Woodlands aboriginal groups. Grinnell (1972) has hinted at this possibility, noting:

> The beaver was reverenced to some extent, no doubt because of the intelligence which was attributed to it, from the fact that beaver built dams to raise waters in streams, and houses to live in. It is said that in very old times beavers were not often killed, and that no Cheyenne woman would dress or even handle a beaver-skin (1972:104).

Harris (1985:459) has emphatically stressed that taboos or prohibitions can serve ecological functions. Descriptions of beaver myths and rituals associated with medicine bundles (Wissler and Duvall 1908) also imply cultural prohibitions against the killing of beaver.

The foremost research strategy in this study is an interdisciplinary approach to the explanation of the historical record of the Northern Plains. The only way to understand the complex range of cultural characteristics found during this time is through the integration of ethnohistorical and ecological approaches. Given the practices and beliefs surrounding the exploitation, or lack of exploitation of beaver by Plains Indians, and using a broad ecological/anthropological framework, a model and/or theoretical framework was developed to provide an understanding of human ecology prior to the fur trade and the arrival of the horse. The model represents a gathering of available facts and ideas and molding them into a pattern; or perceiving patterns in previous observations and integrating these possibilities. The historical and ethnographic records provided the initial clues, both ecological and cultural, in the formulation of the model. An understanding of the ecological dynamics of a particular time and/or area, especially in defining man/animal relationships, was useful in providing contextual meaning to the ethnohistorical information, and in resolving conflicting views or opinions.

Briefly, the model perceives the Northern Plains ecosystem as a unique combination of components and correspondingly interrelationships, contrasting strongly with the ecological dynamics operating in the surrounding Woodlands environment. One of the most important and abundant component was the bison; vast numbers occupied the area attesting to the ideal habitat provided by the dominant vegetation - the grasslands.

The bison, in turn, was the basic economic unit in the subsistence strategies of the early Plains occupants. The annual life cycle and/or movements of these early peoples was thus closely correlated with the migrations of the bison herds. Within the Plains biome lie the Valley Complex (river/stream) systems, the major source of surface water. The scarcity of surface water, both seasonally and particularly during major climatic fluctuations (i.e., drought), strongly highlighted the abilities of beaver to conserve and stabilize this important resource. Within the broader framework of the bison seasonal round, the specificity of human settlement patterns was strongly influenced by the availability of surface water; to a large extent determined by beaver habitat requirements and activities.

The primary hypothesis to be tested is as follows: the non-use of beaver resources by early Plains occupants (prehistoric or historic) was a response to the limited availability of water resources in the Plains ecosystem, and a recognition of the beaver's role in maintaining these resources in the Valley Complex (river/stream) systems. The stabilization of surface water through the non-hunting of beaver was an crucial survival strategy for a pedestrian peoples with limited mobility. Contributing factors to the non-use of beaver resources are low populations, combined with a highly visible and stationary lifestyle, making beaver very susceptible to human overkill. During the early 1800s Thompson, a trader/explorer with the North West Company, also attributed the rapid destruction of the beaver to its peculiar lifestyle, noting that, "as the Beaver is a stationary animal, it could be attacked at any convenient time in all seasons, and thus their numbers soon became reduced" (in Glover 1962:95). The terminology used by Indians [Woodland Cree] in the taking of animals also reflects the beaver's lifestyle. Thompson observed that, "The term "hunting" they apply only to the Moose and Rein Deer, and the Bear; they look for and find the Beaver..." (in Glover 1962:83).

The initial principles or assumptions underlying the above hypothesis, which were formulated in my earlier research (Morgan 1979:225), state that the success of the Plains bison hunting tradition had been largely dependent on the ability of early Plains occupants to recognize the predictable processes (in particular, bison behavior) in the Plains environment. As a result they were able to assess, with a high degrees of accuracy through time and space, the potential of essential resources, thus increasing their availability. This advantage was maintained by: (a) the development of hunting techniques that were non-disruptive of ecological processes; and (b) the non-exploitation of components, e.g., beaver, which guaranteed the availability of a critically limited resource (surface water), particularly during periods of drought. This advantage was also enhanced by using fire to increase the predictability of bison behavior, thus further optimizing the availability of this resource.

Other researchers have also concluded that hunter/gatherers were highly perceptive of networks of causes-and-effects and of the operational systemics of particular environments, and that this knowledge was important in resource procurement strategies. Ridington (1982:478) describes environmental knowledge as a fundamental means of production in hunting and gathering societies. Lewis stresses that "hunting-gathering adaptations involve extensive and detailed understanding of natural phenomena" (1985:75). More specifically, in his ethnographic studies of the Indians of northern Alberta, Lewis (1982a:47) concluded that their use of fire was based on sound ecological principles. Freeman (1985), in his studies of northern Canadian natives, has been particularly emphatic in this regard, stating, "Native perceptions of scientific management programmes ... would give them little reason to doubt the superiority of their own knowledge of animal ecology" (1985:275).

Of significant relevance to the study is the assumption of "uniformitarianism" (i.e., that the dynamic processes operative in the past are still operative today). As Binford (1977) points out, "such an assumption must be warranted to a high degree, since it is central to the development of meaningful arguments about the past that are deduced from contemporary observations on the geological or archaeological record" (1977:8).

When one considers the complexity, and the multifaceted dimensions of human behaviour, interpretation is always a risky business, regardless of the time/space parameters or the theoretical approach. One dimension of this complexity is the ability to make choices, an essential human trait. Sackett, in his study of style, examines and defines the concept of choice.

> ...the specific forms assumed by objects of material culture represent what amounts to a series of specific choices made by artisans, whether consciously or not, from a broad spectrum of equally viable alternative ways of achieving the same end. I refer to such choices as constituting isochrestic (literally, "equivalent in use") variation (1986:630).

Transforming Sackett's concepts to a broader perspective, it can be said that there is often a range of equally viable ways of achieving the same end; choice need not be confined to one expression. Within a relatively short time frame several options may be exercised, perhaps even simultaneously. The choices made are not necessarily the most successful, and may even be detrimental. Our contemporary societies are self-evident examples of the latter case. Overpopulation, pollution, deforestation, economic disparities, etc., are all the result of choices that are diminishing the survival potential of the human race.

Binford (1977:8) suggests that ecological studies are one of the domains better able to support uniformitarian assumptions, as many of the species man interacted with in the past are still available for direct observation. What perhaps gives even greater credibility to the use of uniformitarian principles is that in most animal species, other than man, innate or genetically programmed behavior predominates. According to Treshow (1976:69), behavior patterns of this nature are highly resistant to environment modifications or perturbations. Therefore a corollary to the above premise states that, if processes operating in the past are still operative today, then beaver activities in contemporary valley complexes should effect similar ecological dynamics, i.e., water conservation, as were present in the past. However, a cautionary note must be added. When we speak of programmed behavior it is only in the broadest sense. For example, if one considers the beaver's broad geographic distribution, which transcends several environmental zones, it must be assumed that a high degree of flexibility or opportunistic behavior is also involved.

A fundamental rule, given the nature of living systems, is that ecological knowledge can never be an exacting technology. As Livingston notes, "No two springs are ever alike; things change in nature, and flux does not end with the circling seasons" (1973:19). Turk et al (1972:12) similarly note that all ecosystems fluctuate. They identify factors that can cause an imbalance such as climatic change, migration, drought, flood, fire, etc. An important factor, of course, is contemporary man, who has unprecedented power, according to Ehrlich et al (1973:4), to modify and exploit the environment to his advantage. However, another fundamental aspect of an ecosystem is that flow of energy and matter maintains a high degree of ordered and therefore predictable interrelationships. According to Evans (1969), without a:

> ... multiplicity of regulatory mechanisms.... Processes of growth and reproduction, agencies of mortality (physical as well as biological), patterns of immigration and emigration, and habits of adaptive significance,... no ecosystem could continue to persist and maintain its identity (1969:4).

Early Plains occupants were aware of these broad fluctuating, but predictable patterns. Historical documentation by Moodie and Ray (1976) distinguished this kind of ecological knowledge in relation to bison migrations.

> The migration [of bison] into the parkland in winter was initiated by the need for shelter. The specific temporal and spatial manifestations of this general movement, however, were conditioned from year to year by a variety of factors whose effects were largely predictable to both the aboriginal and non-aboriginal residents of the region. Most important among these factors were winter mild spells, heavy snow, hunting pressures and fires (1976:45).

Several lower order or specific hypotheses have also been put forth for examining the man/beaver relationship in the Plains environment. The following brief summary provides the ecological framework for their development. Environmental studies show that on the Canadian Plains (Fig. 1), even under average climatic conditions, water resources are a limiting factor for both human and animal populations; and by fall are restricted mainly to the mainstreams of the Saskatchewan and Qu'Appelle Rivers (Raby and Richards 1969:61). Thus the importance of the Valley Complex (river/stream systems) to the survival of human populations on the Plains cannot be overemphasized. My earlier research found that, "Factors influencing the selection of the Valley Complex as a preferred winter camp are multiple: adequate water supplies, alternate food resources, shelter, the availability of wood, and of greatest importance, the abundance of bison" (Morgan 1979:180). I also observed that beaver habitat requirements are more frequently accommodated in tributaries rather than main waterways. The presence of beaver in the tributaries would have enhanced the survival potential of the associated human populations by maintaining surface water supplies through the storehouse effect of their dam/ponds systems (Morgan 1979:186). During drought, beaver ponds may be the only sections of streams containing water (Knudson 1962:32).

However, it has also been observed that within a Valley Complex network resource distribution is not uniform, in particular with regard to surface water supplies. Differences in the availability of surface water supplies are most commonly related to the size of the waterway. This factor, combined with the spatial relationships between essential resources, i.e., proximity of surface water supplies to treed areas and shelter, results in certain areas, specifically the large tributaries, providing more favourable habitat conditions for human and/or beaver populations. Ewers (1973:17) has stated that the historic Plains tribes preferred the valleys of the larger tributaries for their winter camp sites.

Given the above, the following specific hypotheses are put forth:

(1) Because of the storehouse effect of the beaver dam/pond systems, most surface water in

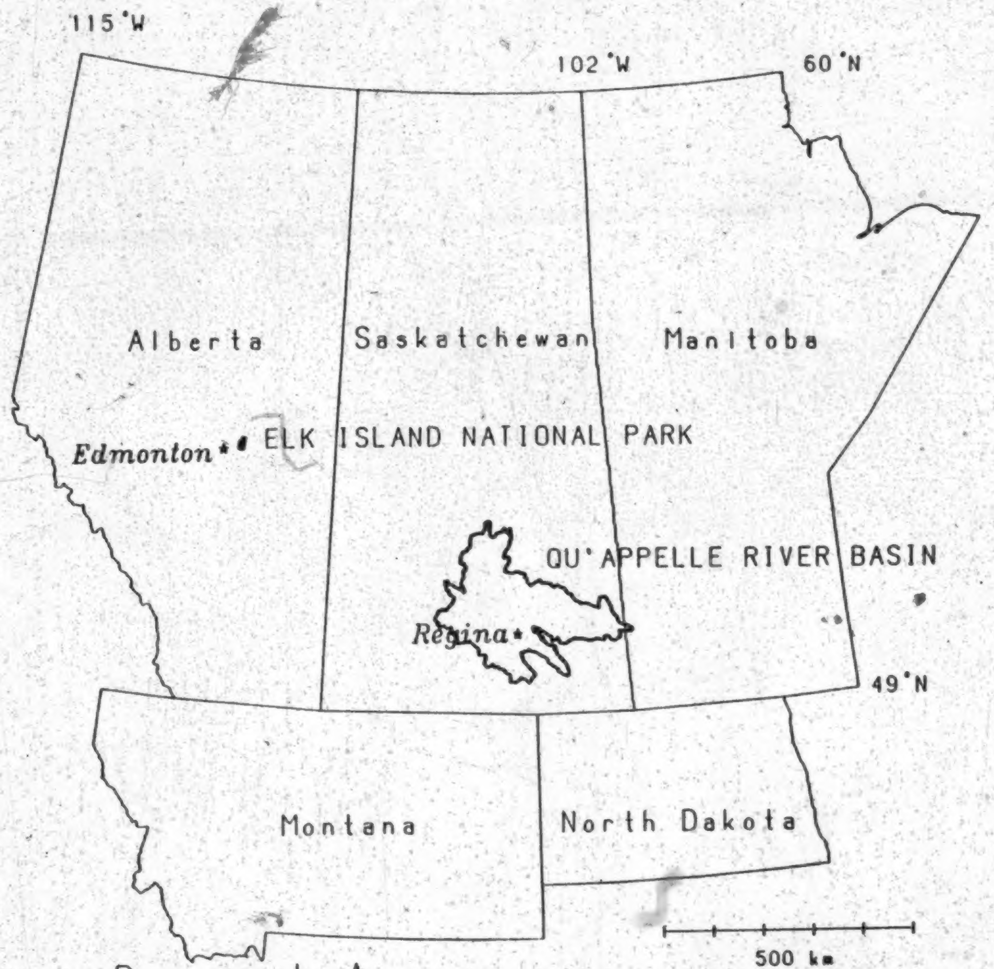

115°W
102°W
60°N
49°N
Alberta
Saskatchewan
Manitoba
Edmonton
ELK ISLAND NATIONAL PARK
QU'APPELLE RIVER BASIN
Regina
Montana
North Dakota
500 km

Figure 1: Major Research Areas

stream tributaries, particularly during drought, is restricted mainly to the beaver-occupied areas.

(2) In the Valley Complex system the most favourable ecological conditions for winter habitation, i.e., adequate surface water supplies in proximity to treed areas, are most frequently found in the large tributaries. For similar reasons beaver populations reach their highest densities in the large tributaries. In terms of the archaeological perspective, large winter campsites, and pounds should have the greatest frequency in this area.

(3) In the small/medium-sized tributaries, in which treed areas and surface water supplies are even more frequently in close proximity to each other, limited surface water supplies, particularly during drought, would have prevented most areas from being used with any degree of permanency by human and/or beaver populations. The archaeological record should reflect these ecological instabilities, with the result that temporary campsites are the most common site type in such areas.

(4) In main waterways inaccessibility to treed areas, due to the considerable extent of the flood plains, would generally act against their suitability as wintering areas for human populations. In contrast, the main waterway, because of the greater stability of its water resources, would be an important wintering area (perhaps crucial during drought) for the beaver populations. The archaeological record should again indicate temporary campsites as a major site type in the area. As the main rivers are a seasonal source of supplementary food resources, i.e., fish, special purpose sites reflecting seasonality should also occur.

The area selected for testing the above hypotheses was the Qu'Appelle River Valley Basin of southern Saskatchewan (Fig. 1) Historical documentation has established that the Qu'appelle Valley Complex was an important wintering area for both bison and human populations. Of equal importance was the profound effect of bison migrations on the settlement patterns of the associated Plains peoples. Mandelbaum (1940) states:

> The migrations of the herds regulated the tribal movements. When the buffalo, drifting southward, crossed the South Saskatchewan in June and July, the

> Plains Cree gathered in large encampments along that river. During the summer months many buffalo roamed the open plains between the Grand Coteau of the Missouri (roughly, the international boundary line) and the Qu'Appelle and Saskatchewan rivers. At that season many of the tribal camps were located in those plains. In the autumn when the herds moved northward into the woods along the Saskatchewan and Qu'Appelle valleys and into the hilly regions, most of the Cree camped in the wooded country (1940:189).

Within the Qu'Appelle River Valley Complex the following waterways, categorized in order by decreasing size, have been selected for analyses:

a) Qu'Appelle River (the main waterway)

b) Wascana Creek and Moose Jaw River (large tributaries)

c) Cottonwood Creek (a medium-size tributary)

To provide a more specific definition of the contrasts and similarities between Woodlands and Plains ecosystems and the resulting effects on man/animal relationships, in particular beaver, ecological studies were also carried out in Elk Island National Park, which is categorized as part of the Parkland-Boreal Forest transition zone (Blyth and Hudson 1987:25) (Fig. 1). In these northern areas more favorable moisture conditions are expressed in a predominance of trees, and numerous lakes and rivers which in turn provide an abundance of habitats for beaver populations. To the aboriginal groups who occupied these areas, the beaver was a major resource providing both food and clothing. As previously noted, Nelson (1973:188), upon observing these differences in response to the beaver, concluded that the Indians of the North became more rapidly dependent on the fur trade than the people of the plains because of their lack of aversion to the hunting of riverine animals.

The validity and/or utility of the theoretical model will be determined by examining three separate data sets: modern beaver ecology in a specific setting relevant to the entire Northern Plains ecosystem; records of the earliest contact period before the fur trade and the horse are important factors; and the prehistoric record of the specific setting in which the beaver study was conducted. The study will then build on this analyticallysupported model of the pre-/protohistoric Northern Plains human ecology to explain the changes that occurred as a result of the fur trade, introduction of the horse, and consequent population movements. It will show how different groups reacted to these factors depending on their previous, and variable, relationships to specific resources such as beaver.

More specifically, chapter II describes the regional setting - the Canadian Plains. Bison migrations and correspondingly human movement patterns are regional in scope. An accurate ecological perspective cannot be gained without a preliminary analysis of this larger environmental zone.

Chapter III, drawing on the historical record, ethnographic studies, previous ecological investigations, and my own fieldwork, develops the theoretical model, i.e., the traditional relationships between aboriginal peoples and the Plains environment as would have been operative at time of contact. More specifically, the analysis examines how human needs, e.g., the availability of surface water, shelter, and firewood are related to the presence of beaver. The annual cycle of human activities will be reconstructed under both normal and drought conditions. To emphasize the differences between contrasting ecological systems (i.e., Woodlands and Plains), a less detailed model of man/beaver relationships is formulated for the Woodlands environment.

Chapter IV is the initial test of the theoretical model from an ecological perspective. The Plains study, in the Qu'Appelle Valley Complex, first examines how environmental conditions in the different size waterways parallel and/or contrast with each other, and how these conditions affect beaver habitat requirements and population size. The main focus is on determining the effects of beaver activities on the environment. Of special concern is the effectiveness of beaver activities in maintaining surface water in these areas. Less detailed ecological studies also were carried out in a Woodlands environment - Elk Island National Park.

Chapter V tests the theoretical model from a historical perspective. The study of the Protohistoric and early contact period first attempts to establish the origins and territorial/political alignments of the various tribal groupings. However, the study's main concern is to test the assumption, implied in the model, that the aversion to beaver hunting would reach its greatest expression in the groups entering the Plains as a pedestrian peoples.

The Blackfoot Nation, consisting of three divisions - Piegan, Blood, and Blackfoot proper - plus the Gros Ventre (allies of the Blackfeet) have been chosen as the representative or focal Plains groups. Several reasons influenced this decision. These groups are generally considered to be the earliest inhabitants of the Northern Plains. Kehoe (1981:276-80) notes that the Blackfeet lived on both sides of the Alberta-Saskatchewan border from at least A.D. 1400, while the Atsina (Gros Ventre) occupied south-central Saskatchewan and adjacent northwestern North Dakota in the Late Prehistoric period. With the exception of a part of the Piegan division, the aversion to beaver hunting exhibits its greatest intensities within these groups.

Another group that will be examined are the Sarsi, who, as they moved from the Woodlands to the Plains in the historic period, became allies of the Blackfeet tribes, and appeared to have developed an aversion to beaver hunting. As well, the Cree and the Assiniboine are a major concern of the study, being not only major antagonists of the Blackfeet tribes but also exhibiting the intra-tribal dichotomy of beaver and non-beaver hunting groups.

Ray (1978:26) distinguishes the Protohistoric as a transitional period between the initial receipt of European goods by the aboriginal peoples and the arrival of the Europeans. In this study the Protohistoric refers mainly to the time period when the events noted above were beginning to be experienced by the Blackfeet tribes. By this time both the Assiniboine and Cree were well into their historic period.

The archaeological analysis in chapter VI is the final test, in that it predicts what archaeologically-verifiable prehistoric settlement patterns ought to look like in the Qu'Appelle Valley Complex if the hypothesis are essentially correct. Within the

Qu'Appelle Valley, Cottonwood Creek (a small/medium-sized tributary) and Wascana Creek (a large tributary) were the selected research areas. The analysis includes the definition of several site type categories, in particular a winter campsite, and a study of their frequency distributions in the different size waterways.

Chapter VII presents the more developed and specific model of beaver, geography and human relationships, and examines how changing conditions in the Protohistoric and Historic periods altered the theoretical model (traditional relationships), verified in the preceding chapters, with the focus centered on how groups that were non-beaver hunters were affected. Although the Historic period witnessed many new changes, i.e., the influx of new populations, and the development of new hunting techniques, an acceleration of many of the changes initiated in the Protohistoric and early contact period also occurred. The most important of these earlier events was the acquisition of the horse, the consequences of which was to significantly alter the pedestrian lifeways. The first section of the chapter gives a detailed analysis of the horse's increasing role in the transformational processes occurring during the historic period. More specifically, the remainder of the chapter examines some of the following assumptions:

A) The preferential treatment of beaver hunters by the fur traders significantly altered territorial alignments, and increased animosities toward the traders and between various tribes.

B) A concerted effort was made by some of the Plains groups, particularly the Blackfeet tribes, to keep the fur trading establishments out of their territories. Attempts were also made to prevent trapping in their areas.

C) A gradual erosion of the prohibition against beaver hunting occurred among some of the Plains Indians. Several reasons will be examined:

1) changing ecological conditions
2) increased tribal animosities necessitating the need for trade goods such as guns and ammunition

3) psychological and monetary pressuring by fur traders, combined with the addictive nature of alcohol

D) The following propositions also are discussed:

1) contrary to the above, some Plains groups were able to maintain the prohibition against beaver hunting up until the end of the bison hunting tradition;

2) the Plains tribes were not responsible for the destruction of the beaver populations in their territories; and

3) until the destruction of the herds, many of the Plains Indians were relatively independent of the fur trade, and participated mainly in the provisions market and buffalo robe trade.

The aim of this study is to provide an integrated view of the changing relationships between people and environment on the Northern Plains in prehistoric, protohistoric, and historic times. It will make an original contribution to knowledge in that it views ethnographic and historical descriptions of the Northern Plains tribes from both developmental and ecological points of view.

CHAPTER II

THE REGIONAL SETTING

INTRODUCTION

An important step in the analysis is the reconstruction of the Plains environment as it might have been just prior to contact. The study will rely heavily on contemporary climatological data and vegetative studies. The validity of inferring prehistoric environmental conditions from contemporary data is based on several conditions, and/or assumptions. First, paleontological data and radiocarbon dates from several Saskatchewan sites (reviewed in Morgan 1979:9-10) indicate that after 10,000 years B.P. a change from spruce-dominated to grassland-dominated biomes occurred. This dominance of grassland vegetation continued into the present. Although the climatic sequence for the Late Plains Indian Period indicates periodic fluctuations from warmer dry conditions to cooler moist conditions and vice-versa (Dyck 1983:68), pronounced climatic fluctuations are a characteristic of the Plains environment persisting into contemporary times, and studies of their effects have been incorporated into many ecological studies. Interestingly, this study's main concern is with the effects of drought, a climatic variable which in the last three years, particularly in 1988, is considered to have reached its greatest intensity during this century (Lang and Jones 1988). Finally the assumption has been made, based on uniformitarianism principles, that processes operating in past are still operative today, and that beaver activities in contemporary Valley Complexes should effect similar ecological conditions as in the past.

The main ecological component under investigation is the Valley Complex: the preferred habitat of men and/or beaver populations, and the major source of surface water supplies (Morgan 1979:182). The area selected for testing this hypothesis is the Qu'Appelle River Valley Complex of Southern Saskatchewan (Fig. 2) which, in my earlier publication (Morgan 1979), I placed on the southern periphery of the bison winter range and attested to

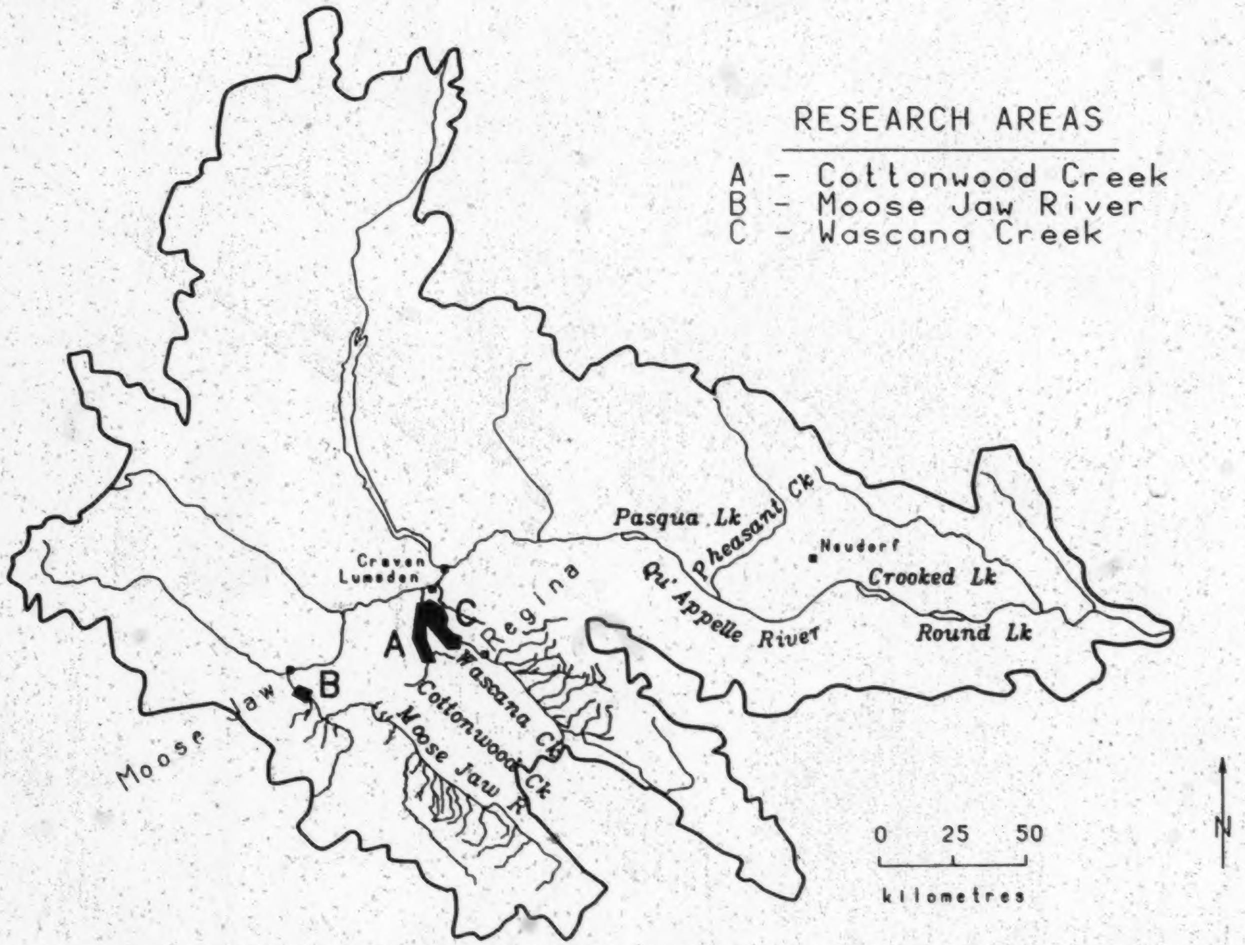

RESEARCH AREAS
A - Cottonwood Creek
B - Moose Jaw River
C - Wascana Creek
Pasqua Lk
Pheasant Ck
Neudorf
Crooked Lk
Round Lk
Qu'Appelle River
Craven
Lumsden
Regina
A
B
C
Wascana Ck
Cottonwood Ck
Moose Jaw R
Moose Jaw
0
25
50
kilometres
N

Figure 2: Qu'Appelle River Basin

its suitability as wintering area for early human populations.

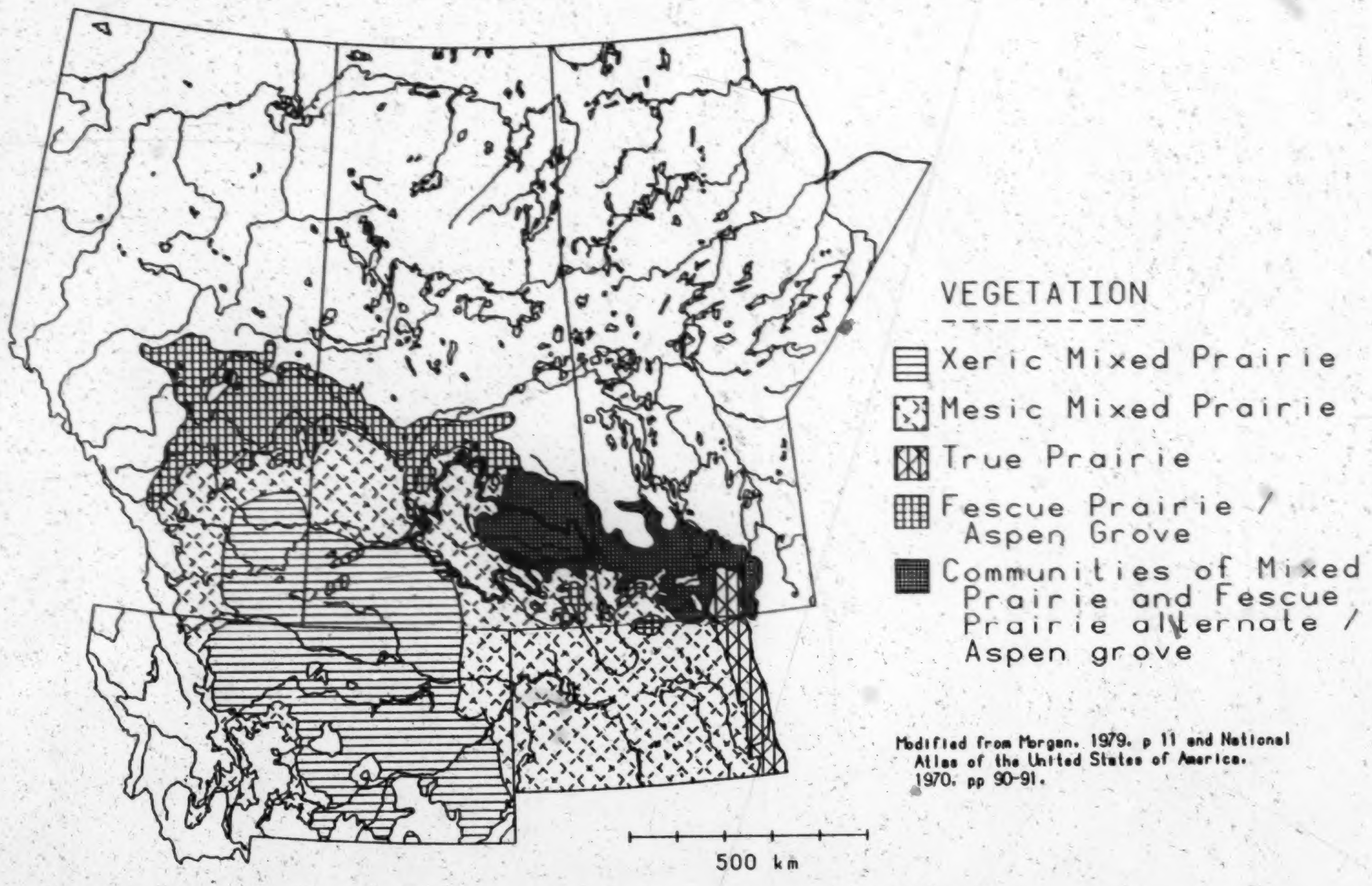
An accurate ecological perspective of the Valley Complex cannot be gained without a preliminary analysis of its significance or role within the larger framework of the Plains ecosystem - in this case the Canadian Plains and to a lesser degree some associated peripheral areas. The information draws heavily on my earlier research in the study area (Morgan 1979).

Although the analysis concentrates on the ecological relationships between Valley Complex / beaver / Man, the importance of the grassland / bison / Man subsystem in the Plains ecosystem cannot be overemphasized. It is within this larger framework, the bison life cycle (Morgan 1979), that the lifeways of the early human populations are considered.

THE NATURAL VEGETATION

The Canadian Plains include almost all the grasslands east of the Rocky Mountains and north of the Canadian - United States boundary (Fig. 3). From an ecotone with the True Prairie in south-western Manitoba, this area extends to the aspen forest in the foothills of the Rocky mountains; on the north it is bounded by the Boreal Forest (Coupland 1961:137)

Within the Mixed Prairie Association, Coupland (1961) has distinguished five vegetative communities or types, which for purposes of analyses, I have grouped into two categories: the Mesic Mixed Prairie, which includes the *Agropyron-Koeleria* and *Stipa-Agropyron* vegetative types; and the Xeric Mixed Prairie, which includes the *Stipa-Bouteloua*, *Bouteloua-Agropyron*, and *Stipa-Bouteloua-Agropyron* vegetative types (Morgan 1979:26) (Fig 3). The Xeric Mixed Prairie is associated with more arid conditions, and *Bouteloua gracilis* (a short grass) is co-dominant with the mid-grasses. In the Mesic Mixed Prairie dominance is restricted to mid-grasses. All of these vegetative types are found in Saskatchewan. The Xeric Mixed Prairie occupies southeastern Alberta, southeastern Saskatchewan, and eastern Montana. The Mesic Mixed Prairie forms an


VEGETATION
▤ Xeric Mixed Prairie
▨ Mesic Mixed Prairie
▩ True Prairie
▦ Fescue Prairie / Aspen Grove
■ Communities of Mixed Prairie and Fescue Prairie alternate / Aspen grove
500 km

Modified from Morgan, 1979, p 11 and National Atlas of the United States of America, 1970, pp 90-91.

Figure 3: Vegetation Zones of the Northern Plains

arc to the west, north, and east of the Xeric Mixed prairie; and occupies Alberta, Saskatchewan, and North and South Dakota. According to Coupland (1961:164-165), the mesic types *Agropyron-Koeleria* and *Stipa-Agropyron* are distinctive to the Canadian Plains. Wright and Bailey (1980:23), however, have observed that the *Stipa and Agropyron* co-dominants in the Canadian area are also present in North Dakota; but in combination with a range of other grass species. The Fescue Prairie - the most mesic grassland community - occupies the northern boundary of the Mixed Prairie from central Saskatchewan westward to the foothills of the Rocky Mountains (Fig. 3).

Within the grassland zone where moisture conditions are favorable, small stands of aspen (*Populus tremuloides*) are found. When such habitats occur with sufficient frequency, the area is classified as the Aspen Grove Region (Fig.3). This region is situated primarily near the forest margin (Coupland and Row 1969:73). In Alberta, the Aspen Grove Region is associated with the Fescue Prairie. In Saskatchewan only the northern part of the Aspen Grove Region is associated with the Fescue Prairie, while east and south it is associated with a transitional type between the Fescue Prairie and the *Stipa-Agropyron* type of the Mesic Mixed Prairie (Morgan 1979:32) (Fig. 3). The True prairie or Tall Grass prairie region occupies the eastern edge of North and South Dakota, and extends into southern Manitoba (Wright and Bailey 1980:24).

The habitats associated with river valleys and old drainage channels are defined by Coupland and Rowe (1969) as the Valley Complex. As the central focus of this study, the Valley Complex is discussed in greater detail under a separate heading.

CLIMATE

The climate of the Canadian Plains, as Coupland (1961) suggests

> ...is characterized by low precipitation, the relative effectiveness of which is increased by low temperatures and

> the short growing season and is reduced by the high drying power of the wind. Deficiency of precipitation is usually a greater hazard to plant growth than either the deficiency of heat or shortness of the frost-free season (1961:138).

The Rocky Mountains, acting as a barrier against the flow of warm and humid air from the Pacific, create drier conditions on the interior plains which cause marked temperature differences between the summer and winter (Chakravarti 1969:60). According to Christiansen (1961:14), temperatures in the Regina-Moose Jaw area have ranged from 100°F (38°C) to -56°F (13°C). Significant temperature differences also occur between various areas. The mean annual temperature is highest in southern Alberta [Xeric Mixed Prairie], reaching 43°F (6°C); but it progressively decreases to about 34° (1°C) at the boundary between the dark-brown (Mesic Mixed Prairie) and black [Fescue Prairie] zones (Coupland 1950:278).

Longley (1972:25) has calculated that in southeastern Alberta and southwestern Saskatchewan [the Xeric Mixed Prairie], the mean annual precipitation rate was 13.2 in (33.5 cm). In southeastern Saskatchewan [Mesic Mixed Prairie], which includes the Qu'Appelle River Valley research area, the mean annual precipitation rate was 16.2 in (41 cm). In central Alberta [Aspen Grove Region], which includes the Elk Island National Park research area, the mean annual precipitation was 17.0 in (43 cm). Marked variations in annual precipitation have also been noted. For example, in the Regina-Moose Jaw area, annual precipitation has ranged from 6.25 (16 cm) to 23.73 in (60 cm), with variations between successive years being as high as 14 in (35 cm) (Christiansen 1961:12). Nearly one-half of this precipitation occurs during the summer months. About one-quarter of the remaining precipitation falls from August to October, while the rest occurs as snow (Coupland 1961:138).

The period of snow cover lasts from 4 to 5 months, starting generally in November and ending in April (Longley 1972:44). More precisely, Blyth and Hudson (1987:13) have defined the period of reliable snow cover as the first and last snow cover lasting seven days or greater. They found that in the Edmonton area this period averages from November 17 to March 27. It is suggested that this period would be significantly shorter farther south on the open Plains.

The winds are mainly westerly, the Chinook winds from the southwest, and the colder winds from the northwest, which are the most typical (Coupland 1950:279). The effect of Chinook winds from the southwest may be felt as far as Regina (Chakravarti 1961:60). They are associated with dryness, dissipation of clouds, and a rise in temperatures. Wind velocities reach their greatest intensities, from 12 (19 km) to 16 miles (26 km) per hour in the Mixed Prairie Association. The frictional drag of the forest cover reduces velocities in the Aspen Grove Region to 9 (14 km) to 12 miles (19 km) per hour (Coupland 1961:140).

Blizzard conditions are also highly variable. Storms which generally develop in the Calgary - Red Deer area register 60 hrs/winter in that area. They move southeast into Saskatchewan, where they reach their highest frequencies; 150 hrs/winter in Moose Jaw and 120 hrs/winter in Regina. Moving northward, the frequencies drop to 30 hrs/winter in Edmonton and 11 hrs/winter in North Battleford (Longley 1972:52).

CLIMATIC CONDITIONS DURING DROUGHT

The main hypothesis of this thesis stresses the importance of beaver activities in maintaining surface water supplies, particularly during drought. It was thus most fortuitous that fieldwork for this study was carried out during a time period said to have experienced the most intense drought conditions of the century (Lang and Jones 1988). What conditions constitute drought? Since moisture from summer precipitation is normally used up by evaporation, the Prairies are highly dependent on fall rains and winter snowfall. When these are lacking drought usually occurs. On the Prairies the worst years in a drought cycle usually had dry falls and winters (Lang and Jones 1988:1).

Comparisons of meteorological conditions during the droughts of the 1930s and the

1980s attest to the severity of the latter.Precipitation totals over the ten year periods 1929-1938 and 1979-1988 are almost identical. Temperatures in the last three years of the 1980s, 1986-1988, have, however, been much warmer, indicating that evaporation in the 1980s was higher than the equivalent last three years in the 1930s (Lang and Jones 1988:7).

More specifically, it was found that the worst precipitation deficits occurred for the 1930s in 1936 and 1937; and for the 1980s in 1986, 1987, and 1988; with autumn, winter, and spring precipitation leading into the summer of 1988 being the lowest on record. It was also noted that in the 1930s the area of drought was concentrated in southern Saskatchewan. The drought years of 1987 and 1988 appear to be more widespread; by 1988 the area of below 70% of normal precipitation covered the southern two-thirds of all three Prairie provinces, while an area of below 50% covered half of the agricultural area of Alberta and Saskatchewan. Moose Jaw was one of the areas most seriously affected by the drought (Lang and Jones 1988:3-7).

Drought conditions were also strongly reflected in the amount of spring runoff that occurred during this time period. As previously mentioned, spring runoff, originating primarily from snow-melt, provides most of the surface water resources in the Qu'Appelle River Valley Complex. In Cottonwood Creek the mean discharge during the 13 year period from 1974 to 1986 was 0.452 cms (cubic meters per second). During the drought cycle (1986-88) mean discharge in 1986 was 0.087 cms; in 1987 it was 0.037; and in 1988, at the height of the drought, it was 0.000 cms, giving a mean of only 0.041 cms for the entire drought period, or 9% of the overall mean (Water Survey of Canada, Station OSJFO11, Cottonwood Creek near Lumsden). On the Moose Jaw River, a large tributary, the mean discharge for a 55 year period from 1910 to 1986 was 2.64 cms. The mean discharge for 1986 was 1.40 cms, in 1987 it was 0.099 cms, while in 1988 it was 0.001 cms, giving an overall mean of 0.50 cms for the drought cycle, or 19% of the overall mean (Water Survey of Canada, 1987-88; Station No. 05JE001; Moose Jaw River above Thunder Creek).

Interestingly, for the equivalent drought years in the 1930s (1936-38) in 1936 the mean discharge was 3.34 cms; in 1937 it was 0.003 cms; and in 1938 it was 0.749 cms, giving a mean of 1.36 cms. Spring runoff was thus much higher during the drought of the 1930s as compared to the drought of the 1980s.

WATER RESOURCES

Two major drainage systems, the Saskatchewan and the Qu'Appelle-Assiniboine, have networks extending into the study area. The southwest is drained by the Milk and Frenchman Rivers. Large areas of southern Saskatchewan are poorly integrated into the major drainage system, and tend to have internal drainage. Melting snow, and spring and summer rains provide local water surpluses, which collect in local depressions but usually evaporate during the summer. Surface water supplies are thus limited mainly to the mainstreams of the Saskatchewan and Qu'Appelle River, and shallow saline sloughs (Raby and Richards 1969:61).

In the northern areas of the province, more favorable moisture conditions are expressed in a predominance of treed areas, and numerous lakes and rivers. In fact, most of Saskatchewan's surface water supplies are concentrated in the north (Raby and Richards 1969:61).

VALLEY COMPLEX

As previously noted, the term "Valley Complex" was coined by Coupland and Rowe (1969) to denote the habitats within river valleys and old drainage channels. They further state:

> Where factors other than the zonal climate are more important in determining the character of the native vegetation, the plant cover is more variable and must be considered as a complex. These complexes are most commonly associated with differences in local availability of moisture and tend to be conspicuous features in the grassland rather than the forest zone (1969:74).

They particularly stress that habitat variability is so great that vegetative descriptions must be kept very general. However, they do distinguish several factors that affect the character of the vegetation such as aspect of slope, steepness of slope, depth of valley, character of substratum, and degree of salinity (1969:74).

Ayyad and Dix (1964:433-434) also stress the importance of aspect and position, but in terms of their effect on soil moisture and temperature, which they suggest are the major factors determining the vegetative character of prairie slopes. They note that on north-facing slopes, soil temperatures are lower and soil moisture conditions are significantly higher then on south-facing slopes. Also soil moisture shows a gradual and constant change from low values at upper elevations to higher values at lower elevations; upper and middle elevations are warmer than lower ones.

The differences in microclimatic conditions between north and south-facing slopes are the consequences of the fact that south-facing slopes receive more solar radiation and are exposed more frequently to prevailing winds (Kendeigh 1961:124).

In the main research area, the Qu'Appelle River Valley Complex, these dynamics are expressed in vigorous stands of trees and shrubs on north-facing slopes and lower ends of tributary valleys. There areas support dense stands of aspen (*Populus tremuloides*), poplar (*Populus balsamifera*), chokecherry (*Prunus virginiana*), snowberry (*Shepherdia argentea*), saskatoon (*Amelanchier alnifolia*), elderberry (*Sambucus spp.*) and rose (*Rosa spp.*) (Canada-Saskatchewan-Manitoba Governments 1972:9)

On southern exposure slopes the vegetation is primarily grasslands. Major grass species include northern wheat grass (*Agropyron dasystachyum*), western wheat grass (*Agropyron smithii*), porcupine grass (*Stipa spartea var. curtiseta*), blue grama (*Bouteloua gracilis*), june grass (*Koeleria cristata*) and forbs such as pasture sage (*Artemsia frigida*) (Rowe 1971, 1973). Shrubs such as snowberry, saskatoon, and chokecherry are also found, with stands of poplar and rose occurring in gullies (Canada-Saskatchewan-Manitoba Governments 1972:9). The vegetation on the flood plains, a mosaic of trees, shrubs and grasslands, also indicates favourable moisture conditions. Tree species include aspen, poplar, Manitoba maple (*Acer negorida*), ash (*Fraxinus pennsylvanica*), elm (*Ulnus americana*), and birch (*Betula spp.*). (Canada-Saskatchewan-Manitoba Governments 1972:9). More mesic grass species such as *Agropyron spp.*, blue grass (*Poa spp.*), and *Stipa spp.* predominate. Also present are species such as wild licorice (*Glycyrrhiza lipidota*), sunflower (*Helianthus*), and wild barley (*Hordeum jubatum*), which usually are associated with moist habitats and deep coulee topography (Coupland 1950:308). At the stream edge, where moisture conditions are most favorable, willow (*Salix spp.*) and red osier dogwood (*Cornus stolonifera*) are found (Canada-Saskatchewan-Manitoba Governments 1972:9). Coupland (1950:308) also includes rose and western snowberry as riparian species.

In summary, in the Valley Complex a range of local factors that tend to be of a constant nature and independent of zonal climatic conditions markedly affect the vegetative nature of the area. One of the effects is a gradient of increasing soil moisture effectiveness that begins at the boundary with the Mixed Prairie uplands and terminates at the stream edge. Another effect is marked differences in microclimatic conditions between north and south-facing slopes. One of the consequences of the above is that a wide range of habitats occur within a relatively limited area. In addition most of the habitats within the Valley Complex, with the exception of upper and possibly middle portions of southern exposure slopes, exhibit more favorable soil moisture conditions than are present on the adjacent Mixed Prairie uplands (Morgan 1979:51).

THE ECOLOGICAL DYNAMICS

On the Mixed Prairie uplands soil moisture is the limiting factor for plant growth (Coupland 1950:277). I concluded that from a focal point in the Xeric Mixed Prairie of southeastern Alberta and southwestern Saskatchewan, a gradient of increasing soil moisture effectiveness radiates, west, north, and east to the Aspen Grove Region (Morgan 1979:61). Increasing soil moisture effectiveness is the result of not only more favorable precipitation rates but other factors that increase the effectiveness of available precipitation: decreasing temperatures, soils, and the sheltering effect of aspen groves. In response to the above dynamics, the grasslands exhibit a progressive increase in vigor and percentage composition of higher yielding mid-grass species, causing a corresponding increase in grassland productivity (Morgan 1979:61). The result of these ecological conditions is an arched geographic placement of major grassland communities around a central area or core - the Xeric Mixed Prairie (Fig. 3).

It should also be emphasized that pronounced climatic fluctuations occur in the study area, causing significant changes in the vegetative nature of the grasslands. Variations in height, with a corresponding effect on productivity, are the initial responses of grass species to changes in moisture supply. If climatic fluctuations are prolonged, changes in density of cover occur, further affecting productivity (Morgan 1979:63). During drought, the most pronounced productivity losses occur in the Xeric Mixed Prairie areas, as little adjustment to decreases in density can be made. In the Mesic Mixed Prairie, the exposed areas of the Aspen Grove Region and the Fescue Prairie, density/productivity losses are partly reduced by an increase in the representation of xeric grass species. In the treed areas of the Aspen Grove Region the sheltering effect of aspens modifies the effects of drought. The Valley Complex is least affected by drought, as beaver and a range of local physical features independent of zonal climate modify its effects on the majority of the habitats. The Valley Complex thus reflects the highest degree of stability in the study area (Morgan 1979:64-65).

THE QU'APPELLE RIVER VALLEY BASIN

The Qu'Appelle River Valley Basin (Fig. 2), located in south-central Saskatchewan, is the area selected to represent the Plains environment. The main feature of the basin, which encloses an area of approximately 20,000 square miles, is a flat, mostly treeless plain. It extends 250 miles from the headwaters of the Qu'Appelle River near Lake

Diefenbaker to its confluence with the Assiniboine River (Canada-Sask-Man. Govts. 1972:xi). The Qu'Appelle River, which is the main waterway draining the basin, flows through seven major lakes, and has ten major tributaries including the specific study areas: the Moose Jaw River, Wascana Creek, and Cottonwood Creek which is a tributary of Wascana Creek.

The upland vegetative communities in the western and southwestern portions of the Qu'Appelle Valley basin are the *Stipa-Agropyron* and *Agropyron Koeleria* types of the Mesic Mixed Prairie Association. More specifically, Wascana Creek and Cottonwood Creek are also associated with the *Agropyron-Koeleria* vegetative type of the Mesic Mixed Prairie. The Moose Jaw River primarily lies along the southwestern periphery of the *Agropyron-Koeleria* type. The northern and eastern parts of the Basin are found in the Aspen Grove Region. Here the associated grassland community is primarily a transitional type consisting of both the *Fescue scabrella* association and the *Stipa-Agropyron* type of the Mesic Mixed Prairie. The more specific description of the vegetative nature of the Qu'Appelle River Valley was discussed in the Valley Complex section.

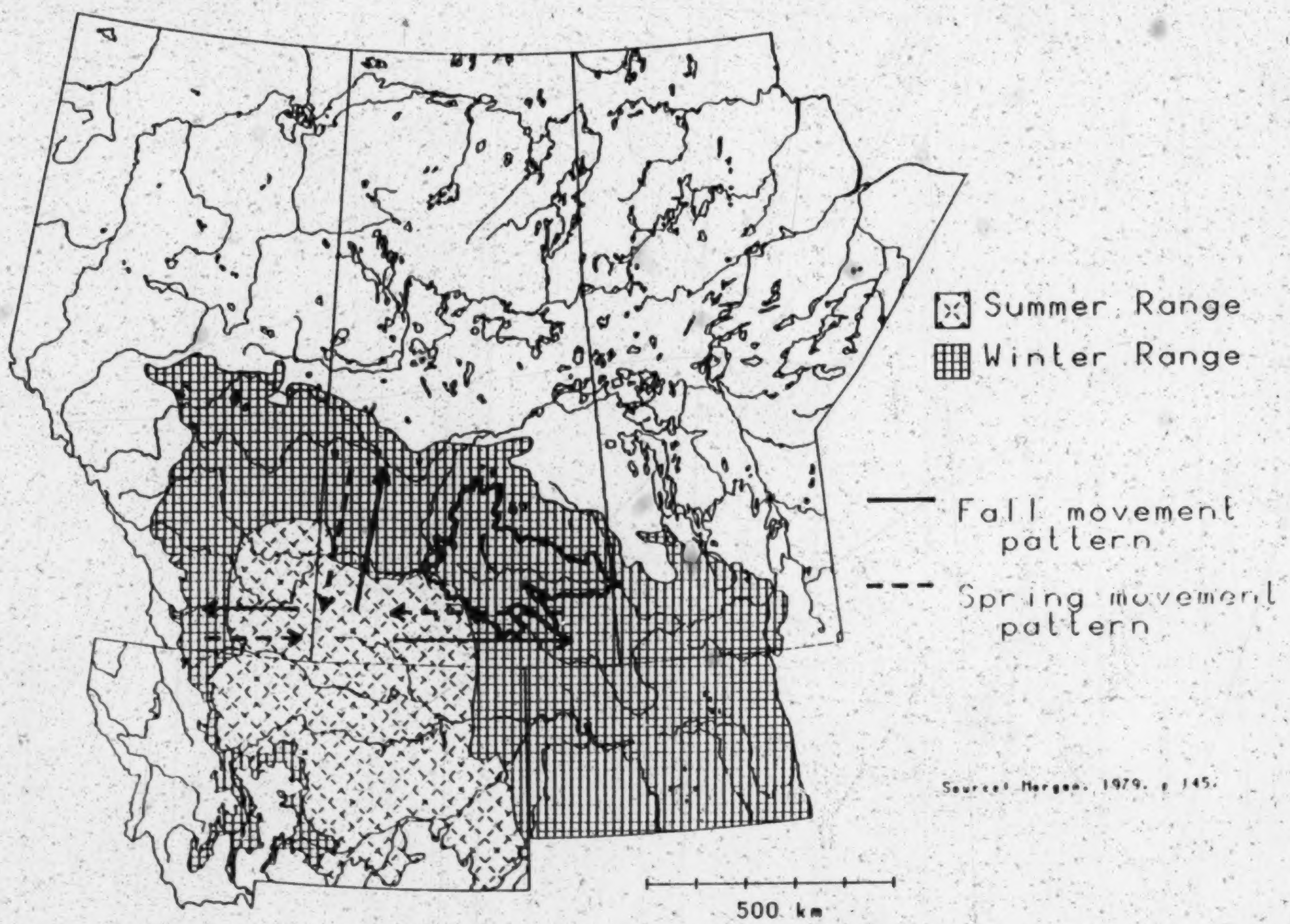
The present day topography of the Qu'Appelle River Valley is largely the result of two factors: (a) the most recent glacial advance (Wisconsinan); and (b) the pre-glacial topography (the Missouri Coteau) which confined the meltwaters that formed glacial lakes Regina and Moose Jaw during glacial retreat. During the final phase of the glacial history of the Regina - Qu'Appelle Valley, drainage of glacial Lake Regina occurred, first through the Moose Jaw Creek channel, then through smaller channels such as Cottonwood, Wascana, and Boggy Creek. The Qu'Appelle Valley was the main glacial spillway for these waters (Kent 1968:4). Eventually abandonment of the Qu'Appelle Basin by glacial meltwaters left many dry valleys with underfit streams. The Qu'Appelle River Valley itself is entrenched from 100 ft (30 m) to 300 ft (91 m) into the surrounding plains, with a floodplain width varying from one mile (1.6 km) to two miles (3 km). A significant postglacial modification in the Qu'Appelle Basin was the formation of alluvial floodplains. Alluvial sediments in the Qu'Appelle Valley range in thickness from 20 ft (6 m) to 40 ft (12 m) (Christiansen 1961:25). The Qu'Appelle Valley was further modified by the formation of alluvial fans at the mouths of tributaries flowing into the main valley; sometimes the fans coalesced to form natural dams providing lakes (Kent 1968:4).

Climatic conditions in the basin generally conform to those discussed earlier for the Canadian Plains. Average annual precipitation ranges from 14 in (35.5 cm) in the western part of basin to 17 in (43 cm) in the eastern part, with snowfall accounting for about 25 percent of the total annual precipitation. Net annual evaporation in the basin ranges from 1.5 ft (0.45 m) of water in the west to less than one ft (0.3 m) in the east. However, evaporation from a free water surface averages from two ft (0.6 m) to three ft (0.9 m) of water annually to extremes of over four ft (1.2 m) (Canada-Sask-Man. Govts. 1972:6-7).

In regard to surface water supplies, the major characteristic of the tributaries is that high volumes of flow occur during spring runoff but little or no flow occurs during the rest of the year. Ninety percent of the total volume of water contributed to the Qu'Appelle River by its tributaries originates from snowmelt, and occurs during the period from March to May; therefore spring runoff is the major determinant of surface water supplies for the year (Canada-Sask-Man. Govts. 1972:8).

BISON MOVEMENT PATTERNS

The bison annual life cycle, which I reconstructed in my earlier research (1979), indicates that the geographic area where the majority of the herds could be found during the summer and early fall was primarily associated with the Xeric Mixed Prairie, and was defined as the summer range (Fig. 4). The winter range included those geographic areas in which the majority of the herds could be found during the spring, late fall, and winter. The major vegetative communities associated with this area are the Mesic Mixed Prairie, the Fescue Prairie of the Aspen Grove Region, and the transitional grasslands of the Aspen Grove Region


▨ Summer Range
▦ Winter Range
Fall movement pattern
Spring movement pattern
500 km

Source: Morgan, 1979, p 145.

Figure 4: Prehistoric Bison Movement Patterns on the Canadian Prairies

As previously noted, on the Canadian Plains these vegetative communities have an arched geographic placement around a core area - the Xeric Mixed Prairie. This pattern establishes a central positioning of the summer range, with the winter range generally located along its outer periphery (Fig. 4).

Depending on where the herds wintered, the general orientation of the bison movements varied considerably. The geographic position of the vegetative communities committed the seasonal movements of the Saskatchewan herds to a north-south orientation. This pattern generally involved a southward movement to the summer range and a northward movement to the winter range (Fig. 4). The Qu'Appelle River Valley Complex lies on the southern periphery of the bison winter range. Herds wintering in the foothills of the Rocky Mountains moved east to the summer range and west to the winter range (Grinnell 1962:234). The Manitoba herds were also committed to a general east-west orientation; however, the geographic placement of the ranges was reversed so that herds would move west to reach the summer range and east to the winter range (Hind 1971:Vol.II:108). Historical documentation (Hornaday 1889:424) indicates that the summer range was also shared with some of the Montana herds. Therefore the Montana herds would move north to the summer range and south to the winter range; the reverse of the Saskatchewan herds.

CHAPTER III

MAN/ANIMAL RELATIONSHIPS: THE HYPOTHESIS

INTRODUCTION

The importance of the bison to the Plains Indians cannot be over-emphasized. According to Kennedy (1961:63) it was "the staff of life" providing them with most of their food and material needs. The migrations of the herds thus strongly influenced the movements of the tribes. Their spiritual relationships to the bison focused mainly on this economic factor. For example, historical documentation by Arthur (1975:88) found that the operation of a drive and the associated ceremonies were under the management of a poundmaster (shaman) who had the supernatural powers to bring the buffalo in. Mandelbum made the interesting observation that as the Cree became more Plains oriented,"the ease with which buffalo could be secured probably caused the atrophy of the Eastern hunting magic and hunting observances"(1979:68). Historical documentation by Roe (1972:643) indicates that there was also a pervading belief among the Plains Indians that the buffalo herds were an inexhaustible resource, emerging each spring in countless numbers from the earth. In other words control of a predictable phenomenon required much less reliance upon the supernatural.

In contrast, the beaver was the central focus, or core, of a more profound and/or encompassing ideological framework. Yet the beaver, itself, contributed little in a direct manner to the material well-being of the Plains groups. According to Lessa and Vogt, myths are stories which are "of crucial importance in providing explanations of how human life came to be, as it is, and in providing justifications for the efficacy of ceremonials and rituals" (1958:142). A Piegan myth eludes to the beaver as a guardian of human life (Wissler and Duvall 1908:77-78). Blackfoot myths also stressed dire consequences if beaver were harmed (Curtis 1970:Vol.VI:70-71); and a Blood version implies supernatural benevolence or power if beaver were protected (Wissler and Duvall

1908 75-76). In addition, among the Blackfeet the beaver was the most important of the animal cults in pedestrian days (Ewers 1958:17). Wissler (1912:168-169) considers the Blackfoot beaver bundle ritual as one of the oldest and most sacred. There were other control mechanisms that seem to have served to protect the beaver and will be discussed more fully in a separate section dealing with the role of beaver in Indian ideological systems.

The importance of beaver in stabilizing and maintaining surface water resources has been strongly emphasized in contemporary ecological studies. Wire and Hatch claim that:

> Thousands of western streams that arise in the high mountains regularly become torrential soil-eroding floods in the lowlands during the spring runoff and then subside to leave dry creek beds during the heat of summer. Since the reestablishment of beaver, many such streams have been altered so fundamentally that their waters rarely attain flood stages in the spring and they have a stabilized flow through the driest summers (1943:91).

Bergstrom (1985:2) found that beaver dams reduce runoff fluctuations; and during dry periods the ponds provide water storage. More specifically, beaver impoundment of water provides increased water surface area, water current deceleration and regulation of stream flows (Allred 1980:3). During drought beaver ponds may be the only sections of stream containing water (Knudson 1962:32).

On the Plains surface water is a crucial limiting factor. As previously noted (Chapter II), on the Canadian Plains, even under normal climatic conditions, surface water, by fall, is generally restricted to the mainstreams of the Saskatchewan and Qu'Appelle Valley Comlexes. Pronounced climatic fluctuations (e.g., drought) are also a characteristic of the Canadian Plains (Coupland 1958, 1959) and markedly affect the availability of surface water. As noted earlier (Chapter II), in the Qu'Appelle Valley spring runoff (90% originating from snowmelt) is the major determinant of surface water supplies for the year. During a drought cycle the worst years have dry falls and winters so that spring runoff is markedly reduced and correspondingly surface water. As a result, on the Plains, surface water is not only limited, but subject to marked fluctuations in availability. Therefore the stabilization of surface water in specific areas by beaver was an crucial survival factor for a pedestrian peoples with limited mobility. Within the broader framework of Plains peoples annual round, the locale of beaver-occupied areas was a important consideration in their movement and settlement patterns. The ethnohistorical record also implies that the Plains occupants were aware of the cause/effect relationship between beaver and surface water. Grinnell's (1972) studies on the Cheyenne found that the sacredness of the beaver was related to its intelligence, and focused on the beaver's abilities to build dams and raise water levels.

Because surface water was limited on the Plains, consequently so were suitable beaver habitats. Low populations combined with a highly visible and stationary lifestyle resulted in beaver being extremely vulnerable to human predation. As noted earlier, Thompson attributed the beavers rapid demise during the fur trade to its stationary lifestyle (in Coues,1962). The possibility therefore existed that even limited hunting could potentially disrupt the critical relationship between beaver and surface water. The beaver thus had to be protected. And as noted, supernatural control was invoked through the mechanisms of myth, ritual, and ceremonies. The above interacting forces set the stage or framework underlying the aversion to beaver hunting that was strongly brought into focus during the advent of the fur trade

Drawing on the historical record, ethnographic studies, and previous ecological investigations, the following chapter will attempt to reconstruct a model of the traditional relationships between Plains and/or Woodlands groups and their environment as would have been operative at time of contact. More specifically the analysis examines how human needs, i.e., the availability of surface water supplies, shelter, and firewood, are affected by the presence of beaver.

The study of man/animals relationships in the Woodlands is not detailed, and centers more specifically on the beaver. The focus is on the effects of beaver-induced flooding, and on the importance of beaver as a directly usable resource, e.g., providing food and clothing. Studies on the Plains are more comprehensive, as they are central to establishing the theoretical framework for the primary hypothesis: that the non-hunting of beaver by early Plains occupants was a response to the limited availability of surface water in the plains ecosystem, and furthermore a recognition of the beaver's role in maintaining these resources in the Valley Comlex (river/stream systems).

Using the Qu'Appelle River Valley as a focal point, the analysis follows a hypothetical prehistoric human population through an annual cycle. In an earlier publication (1979) I reconstructed an annual life cycle for the human populations in southern Saskatchewan, which is used as the framework. In turn, recognizing the close relationships of the earlier Plains occupants with the bison herds, and correspondingly the effects of bison migrations on the movements and settlement patterns of these peoples, the human annual cycle is also correlated with the bison annual cycle. Because of the pronounced climatic fluctuations associated with the the Plains ecosystem, and their marked effect on surface water availability, the annual cycle will be reconstructed under both drought and average climatic conditions.

THE PLAINS

The Human Annual Cycle

Average Climatic Conditions

On the Canadian Plains the bison summer range was positioned centrally, with the winter range located along its outer periphery (Fig. 4). The geographic placement of the ranges committed the seasonal movements of the Saskatchewan herds to a general north-south orientation: north to the winter range, south to the summer range. The Qu'Appelle Basin area lay within the bison winter range on its southern periphery. Waterways such as the Moose Jaw River had tributaries extending into the outer peripheries of the bison summer range.

Spring thaw, with its excessive moisture conditions, and spring runoff, which can result in flooding, make most low-lying areas in the region uninhabitable. Hind (1971:Vol.I:328) has noted that during spring runoff in the main Qu'Appelle Valley, water levels may be eight feet higher than in the summer. Human populations that wintered on the valley bottoms of the large tributaries would have been forced to move to higher ground. Movements were generally of a highly localized nature. Major herbivore movements, particularly bison, out of the Valley Comlex and sheltered areas of the Aspen parklands would be influenced as well by the earlier emergence of new spring grasses on the exposed prairie uplands. These herd movements imply a sudden scarcity of essential resources in proximity to the winter camp areas. However, if upland grasslands in the vicinity of the residential camps were fired, in late winter or early spring, then large herds would tend to aggregate in these areas.

On the Northern Plains, the attraction of bison to grass on burned areas has been historically documented by several investigators such as Arthur (1975), and Higgins (1986). Contemporary studies on the effects of fire on ungulates, have similarly established the attraction of herbivores to burned areas (Daubenmire 1968; Penfound and Kelting 1950). Ethnohistorical documentation also indicates that the burning of grasslands by Plains Indians occurred primarily in autumn or early spring, or occasionally in winter (Arthur 1975:24; Lewis 1982b:49; Higgins 1986:5); therefore, by controlling herd movements through the use of fire, traditional hunting techniques could be maintained during this time period. According to Arthur (1975:23), fire was also used by the northern tribes in the initial phase of the bison drive to herd or manipulate the animals (up to 40 miles) to the pound or processing area.

Eventually major herd movements to the summer range would occur initiated by the availability of superior forage. Bouteloua gracilis, a short grass dominant on the summer range, commences growth in early May, about a month later than the mid-grasses; and thus is still immature and highly nutritious (Morgan 1980:152).

The summer grazing pattern of small nomadic herds dispersed over the range sharply contrasts with the overall winter phenomenon of large sedentary herds aggregating near sheltered areas. Differences in forage capacities were the major influence on these distinctions. The annual forage capacities of the summer range are about one-half of the capacity of the open grasslands on the winter range, necessitating the more nomadic and dispersed grazing pattern (Morgan 1980:151).

Major human movement to the summer range would have been initiated some time after the first week in May. During these movements, that is, until the herds were located on the summer range, dried provisions became an important staple of the human diet. The historical record indicates that a major activity associated with winter drives was the production of dried provisions. While wintering with the Piegan, Thompson observed that herds were driven into pounds from the middle of January to the middle of March; and that, "During this time the women are busily employed in splitting the flesh into thin pieces and hanging it over the smoke to dry, and when dried is a favorite food to all people" (in Glover 1962:51).

Human populations would probably have traveled cross-country, as surface water would be generally available; both melting snow and spring rains would provide local accumulations. Waterways would be generally avoided for two main reasons: most of the large faunal forms (deer, elk, and bison) that were sources of food had left the valleys, attracted by the new spring growth of grasses on the uplands; and to follow the tributaries would have entailed an unnecessary expenditure of energy. John McDonnell, in describing the Assiniboine River, notes that it is:

> ...one of the most crooked that fancy can conceive. A man on foot, who marches straight through the plains, in three hours time can go as far as the canoes in a day (in Masson 1960:Vol.I:268).

Hind's comments indicate that canoe travel on the Qu'Appelle River posed similar problems.

> The tortuous character of the stream, before we took the canoe out of the water, may be imagined from the fact that eleven hours constant, steady tracking enabled us to progress only five miles in a straight line through the valley, and not less then 200 courses and distances were recorded in the canoe (1971:Vol.I:331-332).

These conditions represents the main reason why the canoe, as a transportation vehicle, did not gain much favor on the Plains.

On the summer range, bison had an organizational pattern of small, nomadic herds dispersed over a large area (Morgan 1980:152). Human populations following the herds to the summer range were thus faced with a critical resource dispersed over a wide area. However, if areas particularly suited for summer residence, i.e., treed, with sufficient surface water supplies, were fired in fall, prior to human movements to the winter range, then a convergence of high density herds would occur in these areas. Given the above dynamics, it would have been possible for human populations on the summer range to continue communal hunting techniques, and to remain relatively sedentary. I have previously estimated occupancy of the summer range at about three to three and one-half months (Morgan 1979:182).

During the rut, which peaked sometime between mid-July and mid-August, the behavior of bison herds alters, becoming not only unpredictable, but more aggressive. The manipulation of the herds (based on predictive behavior), so important in the successful operation of a pound, was not only no longer feasible, but dangerous. Frison (1967) has also noted that, "... lacking horses, it would be extremely difficult to successfully execute a buffalo drive if young calves or cows in rut were present in a herd" (1967:32). Given this situation, I have estimated that the human populations abandoned the bison summer range by about mid-August (Morgan 1979:179). There were other complementary factors initiating these movements: (a) water resources on the summer range were becoming limited; and (b) alternate food resources - elk, deer, berries etc. - were abundant in the valleys of the bison winter range. The limited availability of surface water resources is a particularly critical factor. Even during average climatic conditions, with the exception of early spring, surface water resources on the open plains are not abundant. Cowie, a trader in the Qu'Appelle district, noted that:

> In summer, too, there was greatest dearth of water, and when it was to be had at all it was often horribly alkali, or, if the buffalo were numerous, tainted with the foul excretions of the wallowing herd (1913:207).

By fall the situation would have been critical. As previously noted, on the Canadian Plains the area that would have been associated with the summer range is not well integrated into the major river systems. It was also observed that by fall local water resources evaporate; and surface water is generally restricted to the mainstreams of the Saskatchewan and Qu"Appelle river systems. Therefore, the return to the winter range would essentially entail locking into the Valley Comlex networks. The small-to-medium-sized tributaries would serve primarily as migration corridors, as the groups moved inward to their wintering areas on the larger tributaries. More specifically in the study area, the Moose Jaw River, with its tributaries projecting into the summer range, would play an important role in these movements.

At this time, the importance of beaver in maintaining surface water comes into play. As previously noted, contemporary ecological studies have stressed that surface water resources of any appreciable amount, by fall, would tend to be confined and/or maintained near beaver-influenced areas. However, distribution of surface water in the Valley Comlex systems is also highly variable, with the least abundance being attributed to the small-to-medium-size tributaries. For example, in Cottonwood Creek (a small tributary) the mean discharge during a 13 year period from 1974 to 1986 was 0.452 cms, while on Moose Jaw River (a large tributary) the mean discharge for a 55 year period from 1910 to 1986 was 2.64 cms. (Water Survey of Canada). In the main waterway, the Qu'Appelle River, even during a drought year (1987), mean discharge was 4.32 cms, substantially higher then in the tributaries. In addition, small tributaries tend to be intermittent. In Cottonwood Creek stream flow generally ends by July; the mean number of days of flow per annum is 81.6. In a small tributary ,as compared to a large one, because of more limited surface water, suitable beaver habitat would be restricted and consequently the availability of surface water. There is reason to suspect that by fall on a small tributary surface water may be mainly limited to beaver pond systems. In north-central Arizona (Ffolliott et al 1976:132) studies on an intermittent stream (mean flow per annum of 100 days) found that it was a dry drainage with isolated beaver ponds during most of the year.

As the human populations moved back to the winter range, the beaver-occupied areas on the smaller tributaries would have been a crucial source of water. In addition they would have attracted alternate food resources.such as elk and deer. Knudson notes that beaver influenced areas show "...marked density increases for many animals and substantial increases in the number of species using most of the ponds and meadows and their invirons as compared to the density and variety of species using the stream above and below the beaver pond and meadow"(1962:43). Herbivores would be attracted to these areas not only by the availability of water, but by superior forage as well. Beaver dams raise water tables so that the associated grasslands continue to grow and remain green longer, while forage elsewhere would have cured and become less palatable (Wire and Hatch 1943:91). Beaver activities also provide firewood; however, this aspect of beaver behavior will be discussed within a separate section.

On the winter range what specific factors would influence the choice of a wintering area? In my earlier research I provided a broad definition, noting that the "Factors influencing the selection of the Valley Comlex as a preferred winter camp are multiple: adequate water supplies, alternate food resources, shelter, the availability of wood, and of greatest importance the abundance of bison" (1979:180). Several other authors have attempted to define the factors influencing the selection of a suitable wintering area. Bushnell (1922:20) noted that the permanent camping grounds of the Cree are always placed near a supply of fuel. For the Assiniboine, Kennedy (1961) observed that, "After roaming the prairie from early spring until late in the fall, the tribe, when the winter came, camped along the large, heavily wooded rivers, where there was fuel and shelter" (1961:117). Wallace and Hoebel (1964) note that the Comanche and Kiowa allies preferred to camp, "Along meandering creek valleys toward the headwaters of larger streams, where there were adequate canyons, arroyos, and breaks for protection, abundant grass for the large horse herds, ample buffalo and antelope for food, wood for the camp fires, and sweet water for drinking... (1964:15). In the above, Wallace and Hoebel have stressed, in terms of adequate shelter, some form of slope wall. Dodge (1959) mentioned the presence of trees as a significant factor in providing shelter. He states that in choosing a stream for a wintering camp the Indians specifically looked for attributes such as "...the shelter furnished by the bluffs on each side of the stream, of the amount of timber and wooded thickets along its valley, of the sufficiency of grass or cotton-wood to keep ponies alive" (1959:242). In describing the winter camps of the historic plains tribes such as the Gros Ventre and Blackfoot, Ewers (1973) gives perhaps the most comprehensive and precise assessment of what constitutes a good wintering area in the Valley Comlex.

> It would have been suicidal for these Indians to have remained on the open plains in the treacherous winter season of intense cold, high winds, heavy snows and blizzards. In late October or early November each band sought the shelter of a river valley where they could pitch their lodges among the trees and obtain shelter from the elements. They preferred winter camp sites where high banks afforded protection from winds, and required locations which would provide not only good drinking water but sufficient wood for their campfires and grass to pasture their horses. Not all river valleys met these requirements. Generally, it was only the valleys of the larger tributaries that did. So long as the food supply held out and the necessary timber and grass were available the band could and often did remain in that location all winter (1973:17)

All authors have singled out shelter as an important factor in the selection of a wintering area. The hazards of remaining on the open Plains during winter have been frequently mentioned in the historical record. Denig, a fur trader during the 19th century, states that:

> The winters are variable, mostly very cold, with deep snow. In the severest cold the mercury freezes and the degree cannot be determined in this way. It often remains frozen for several days and for weeks ranging between 30 and 40 degrees below zero. The snow storms in these times are terrible and certain death befalls those who are caught on the plains (1961:67).

David Thompson, while crossing the open plains in winter from the Souris River to the Mandan villages on the Missouri, personally documented the dangers of such an undertaking. A journey which required 33 days to perform took only 10 days in good weather. Low temperatures reaching 32 below, and frequent severe storms led him to comment that:

> I am utterly at a loss to account for such violent winds on this part of the Plains, and this may account for the few Bison we have seen, and the smallness of the herds, which rarely exceed twenty;... we have not seen the track of the Deer, and even a Wolf is a rare animal, as for Birds we have seen none (in Glover 1962:167).

The Assiniboine with whom Henry [the elder] was travelling during the winter of 1776 impressed upon him the dangers of travelling on the Plains during both summer and winter.

> ... the Chief informed me... that the intervening country was a tract destitute of the least appearance of wood. In the winter, as he asserted, this tract cannot be crossed at all; and in the summer, the traveller is in great danger of perishing for want of water; and the only fuel to be met with is the dung of the wild ox. It is intersected by a large river [Saskatchewan] which runs to the sun's rising, and which has its sources in the mountains (1969:303).

That the need for shelter by early Plains occupants was critical in winter cannot be denied; however, the selection of a suitable wintering area in the Valley Comlex is governed by a range of additional factors of at least equal importance. Perhaps the most important one mentioned in the descriptions of wintering areas, which also must be the initial consideration in selection, is that large-size waterways were best able to provide the other essential requirements.

The ethnohistoric reports, however, indicated a rather late occupancy of the winter range (as late as November) for the historic equestrian tribes. I suggested a much earlier occupancy date for the Prehistoric pedestrian peoples due to the dangers of bison hunting during the rut, and because the predictive behavior essential for the successful manipulation of herds during a drive are altered (Morgan 1979:178). During the historic period the acquisition of the horse reduced significantly the dangers of hunting herds engaged in rutting activities. The "chase", a technique which evolved with the acquisition of the horse, was the preferred method of hunting during the spring and summer (Mandelbaum 1940:191; Ewers 1958:76). The chase, as described by Ewers, "...was a straightaway rush by mounted men, each hunter singling out an animal from the herd, riding alongside it and killing it at close quarters...." (1955:154). As can be seen, the chase required little more than the element of surprise for its successful operation. Therefore, prior to contact, occupancy of winter range should have begun about mid-August, and should have been completed by mid-September.

As previously noted, the period of reliable snow cover would begin at earliest in mid-November, but most likely by the end of the month. Thus there is a period of about two to two-and-one-half months when the Valley Comlex systems would be almost the only source of surface water. In my previous research (Morgan 1979) the factor considered to be particularly important in the selection of a wintering area was the presence of sufficient surface water, which in the above historical quotes was generally not emphasized, perhaps being considered a given. The limited availability of surface water on the plains, especially in fall, was just as critical a factor in survival as shelter in winter.

As discussed earlier (Chapter II), tree/shrub species in the Qu'Appelle Valley are mainly restricted to northern exposure slopes, ravines/coulees, and the stream edge. Since surface water is intermittent on a small tributary, many sections become dry by fall. As a result stream-edge vegetation (riparian species) would be associated primarily with beaver occupied areas. In a large tributary surface water is more abundant and flow continues well into October; the mean number of days of flow per annum is 190.8 (Water

Survey of Canada). In other words water is more uniformly distributed and available. Accordingly riparian species are of greater abundance, and tend to be more continuous along the stream edge. Beaver can choose from a broader spectrum of suitable habitats, leading one to suggest that they reach their highest densities on large tributaries. Beaver thus are able to create a more extensive and therefore more stable network of dam/pond systems. These ecological conditions would provide the ideal habitat for large winter campsites.

Since tree/shrub species also are limited in the Valley Comlex systems, a factor that must be considered is whether the beaver's need for construction materials would adversely affects the availability of adequate shelter conditions for the resident human populations. There are differentials in habitat requirements that, from a localized perspective, could perhaps shift beaver and human populations into slightly different spatial niches removing them, to some extent, from direct competition for the same resources. Beaver are not only highly sedentary, but are restricted to a narrow foraging range. There is a general consensus of opinion that most trees are utilized within the first 30 m (100 ft) from the water (Jenkins 1980a:742; Hall 1960:487; Todd 1978:19), with Hall specifying that 90% of the cutting occurred within this range. Estimates for maximum foraging radius ranged from 100 yards (91 m) to 500 ft (152 m) (Hodgdon and Hunt 1955:432; Hall 1960:487; Rutherford 1964:17; Longley and Moyle 1963:35; Strong 1982:49; Bradt 1938:156). Thus beaver-occupied areas would tend to be found on sections of the waterway that are proximate to treed areas. Human populations, on the other hand, need a broad expanse of floodplain for a wintering area, since groups at that time of the year are relatively large. Arthur (1975), on the basis of historical documentation, concluded that, "... the bison moved onto their winter range where they tended to form larger, more sedentary herds and aggregate herds, thereby permitting the formation of large Indian encampments in the vicinity of these large herds..." (1975:121). Therefore, the need for a larger area would place most wintering areas at a distance somewhat removed from where the waterway approaches the slope wall. In the fall, when the waterway serves as a focal point for surface water supplies, weather conditions are still relatively moderate. Lack of shelter (open canopy) would not present any great hardships to the resident human populations. The removal of trees, by beaver, in the vicinity of the waterway could actually be considered beneficial; initiating a successional pattern to grassland areas, which would attract more herbivores. With snow (mid-November or later) removing the reliance on the waterway for water resources, and the subsequent freezeup of ponds, human groups would shift to the treed areas adjacent to the northern exposure slope walls or ravines. Ewers (1955) also has described how seasonality affected the spatial distribution of the groups occupying the wintering areas:

> When the band arrived at the site chosen for winter camp they usually pitched their lodges in the open for a few weeks. As the weather grew colder, around the end of November or early December, the chief gave orders to move the lodges in among the thick timber of the valley (1955:124).

Considering the beaver's narrow foraging range, most of the wooded areas (often aspen) along the slopes would be inaccessible, especially in the larger waterways. On the Lower Souris River, Hammond (1943:317) found that most aspen stands are usually several hundred yards from the river and are generally not available for beaver use.

I have also stressed (1979:125) that one of the factors influencing the selection of the Valley Comlex as a wintering area was the abundance of bison, which can be attributed to several factors. By fall, the availability of superior forage, as well as the presence of surface water, drew herds back to the winter range. Grasses were still green and nutritious, particularly in the Valley Comlexes. Herds tended to concentrate near the waterways until late November. At this time conditions were favorable for intensive bison drive activities. In late November, the first snows provided alternate water sources, so that the herds tended to move out on the exposed grassland areas; during this time dried provisions would be heavily drawn upon. These conditions were of short duration, as adverse weather conditions soon forced the herds back into the sheltered areas. Mild winters also allowed the herds to remain on the exposed grassland areas for prolonged periods. Under these conditions alternate food resources such as elk and deer became important components of the diet. Once the herds entered the sheltered areas, they tended to remain in the vicinity of these areas for the rest of the winter.

The movements of bison herds to sheltered areas during the winter has been historically recorded by several authors. Hind (1971) notes that, "...the prairie buffalo, ...generally avoids the woods in summer and keeps to the open country; but in winter they are frequently found in the woods of the Little Souris, the Saskatchewan, the Touchwood Hills, and the aspen groves on the Qu'Appelle" (1971:Vol.II:106). Mandelbaum's observations (1940:180) on bison movements in the same geographic area generally concur with those of Hind. Alexander Mackenzie made similar observations for the North Saskatchewan, noting:

> ...on the West and North side of this great river, is broken by the lakes and rivers with small intervening plains, where the soil is good, and the grass grows to some length. To these the male buffaloes resort for the winter, and if it be very severe the females also are obliged to leave the plains (1802:51).

During winter storms, the seeking of shelter by bison was vividly documented by Henry [the elder] in 1776, while he was camped near a wooded lake in the Aspen Grove region of Saskatchewan.

> In the morning, we were alarmed by the approach of a herd of oxen, who came from the open ground to shelter themselves in the wood. Their numbers were so great, that we dreaded lest they should fairly trample down the camp;... The Indians killed several, when close upon their tents; but, neither the fire of the Indians, nor the noise of the dogs, could soon drive them away. Whatever were the terrors which filled the wood, they had no other escape from the terrors of the storm (1969:286)).

With the herds in proximity to the wintering areas, communal hunting techniques were resumed; and according to Arthur (1975:121), were carried out for the duration of the winter. Briefly, traditional hunting techniques, those employed before the acquisition of the horse, appear identical to the drives used on the Northern Plains during the late Prehistoric period (Arthur 1975:96). The success of these hunting techniques was dependent on the manipulation or enticement of the bison herds to the processing areas, with a minimum disruption of their behavior patterns. Kehoe (1973:181) has observed that each runner had his own method, often based on imitations of a bison calf in distress. Also, all animals captured during a specific drive were killed. It was believed that if the animals escaped they would transmit this knowledge to other animals, thus jeopardizing the success of subsequent drives (Kurz 1937:146; McDougall 1896:282; Nelson 1973:151). I concluded that ecological knowledge, in this case awareness of predictive bison behavior, led to the evolution of non-disruptive hunting techniques, "guaranteeing the presence of the herds in an area for subsequent hunting operations, an important survival factor for pedestrian people" (Morgan 1979:113).

Of the different size waterways, surface water would be most abundant and therefore the most stable in the main waterway. Beaver occupying the main waterway under normal conditions would not directly contribute to the maintenance of these resources. On the Qu'Appelle River strong stream flow generally acts against the construction of dams and lodges (Sherratt and Hatch 1977:14); but beaver populations that maintain surface water in the tributaries would indirectly contribute to the continued flow into the main waterway. However, inaccessibility to most tree/shrub species, due to the considerable expanse of the floodplains (Sherratt and Hatch 1977:14), places a limit on food resources which, in turn, restricts beaver population size. Similarly for the human populations, spatial incongruity between surface water, and shelter and sources of firewood would act against the main waterway being suitable as a wintering area.

With the coming of spring the cycle was complete. Melting snows and spring runoff creating excessive moisture conditions, and the movements of the herbivores to the open plains, again led the human populations away from the Valley Complex systems.

Human occupation of the winter range should have ranged from eight to nine months.

Drought Conditions

The years 1986 to 1988 coincided with what is considered to be the worst drought cycle of the century. Using the climatic data recorded (Lang and Jones 1988; Environment Canada: Atmospheric Environment Service, Water Survey of Canada) during this time as a reference point, the study will attempt to infer how human populations, prior to contact, would have coped or adjusted to these changes. Some of the regional aspects of the drought were discussed in chapter II.

In my earlier research (1979) I suggested that during the initial stages of a drought cycle, both human and bison movements to the summer range would not have been significantly affected. Reduced precipitation and/or higher temperatures during the vegetative season would bring about several environmental changes: (a) local water resources would evaporate sooner; (b) grassland productivity would be reduced; and (c) the grasslands would reach the curing stage earlier (Morgan 1979:136). It is doubtful that these changes would seriously affect human movements to the summer range, or the return to the winter range. Surface water sources along the migration corridors would not be markedly reduced, as spring runoff is the major determinant of its abundance; but given the higher temperatures resulting in higher evaporation rates and reduced precipitation, then water loss in the waterways would be somewhat greater then normal.

Increased water loss would result in a contraction of the beaver dam/pond systems. Because of marked drops in water levels, some beaver populations may be forced to reestablish to lower levels, generally on the same waterway. On the Snake River in Wyoming, Collins (1979:351) found that although some abandonment of dwellings occurred during high water in spring, the most pronounced movements occurred in low water in mid-September. Colonies that reestablished in their own territories moved an average distance of 262 m. The larger waterways would not be affected to any great extent.

There is no evidence that a single year of drought would have inconvenienced the associated human population. Again, faunal populations would be abundant in the vicinity of these beaver-occupied areas.

The earlier curing of the grasslands, and reduced forage capacities, however, might have provide the impetus for an earlier return of the bison herds to the winter range. These earlier fall movements could be considered advantageous, as they reduced the period of human dependency on dried provisions and alternate food supplies (Morgan 1979:183). It is also debatable whether a single year of drought would have had any significant effect on the mortality rates of bison populations. Climatic fluctuations on a year-to-year basis are a common occurrence, so that bison populations stabilized at a point where conditions of this nature could be accommodated, if they were the exception rather than the rule (Morgan 1979:137).

Going into the fall/winter critical variables relating to a drought cycle come into play: reduced snowfall and fall precipitation. As noted earlier (Chapter II), the corresponding effect would be a marked decrease in spring runoff. For example, in Cottonwood Creek (a small tributary) during the second year of drought (1987), discharge flow during spring runoff was reduced by 58%. Again, there is no evidence to suggest that any of the climatic changes would have appreciably affected spring movements, for both human and bison populations, to the summer range.

On the summer range local water surpluses, being mainly dependent on snowmelt, would be markedly reduced. A continuation of high temperatures, therefore higher evaporation rates, and reduced precipitation, would all negatively impact on the remaining water resources. The rapid diminution of surface water resources would have provided the impetus for human populations to vacate the summer range at an earlier date. As they moved to the winter range, water resources along the migration corridors would also have experienced a marked reduction. The contraction of beaver dam/pond systems would have accelerated. Some would become dry; while others would separate into discrete pools of water. Nevertheless, during drought beaver ponds may be the only source of water, particularly on small tributaries. Beaver abandonment, in many cases, would be of a more permanent nature, entailing movements to larger waterways. Collins (1979:351) noted that on the Snake River, when side channels became dry, beaver populations moved to the main river channels

Given their knowledge of ecological processes, I argue that these reductions in water resources would be predictable and the location of the most stable beaver occupied areas known to native peoples of the Plains. However, it is once more emphasized that as the human populations moved through these smaller tributaries, from the summer range to the more stable wintering areas on the larger tributaries, the remaining active beaver ponds, and to some extent the abandoned ones, would have been a crucial source of water.

It is highly fortunate that in earlier times human populations returned to the winter range before the majority of the herds. Considering the immense size of these herds, by time winter snows arrived most of these ponds would have been drunk dry. Dary (1975) historically documented several occasions when the bison herds drank a waterway dry. More specifically he notes that Durfey, an old buffalo hunter, recalled seeing a ..."herd of buffalo drink the Solomon River dry and the river was twenty-five feet wide and a foot deep before the buffalo came"(1975:34).

Another important survival factor is the fact that abandoned dam/ponds systems continue to be viable (capture and contain surface water) after abandonment by their beaver colonies. The durability and/or resistance of beaver dams to climatic perturbations has been historically observed by Thompson, who notes that, "Dams erected by the art of Man are frequently damaged, or wholly carried away by violent freshets but no power of water has ever carried away a Beaver Dam" (in Glover 1962:153). Contemporary ecological studies also point out the durability of beaver dams. Retzer et al observed that as beaver colonies mature repairs to dams are made mainly with soil so that, "Such repair adds a degree of permanence because the dam eventually approaches an earth dike in composition"(1956:25).

The remaining surface water resources, being mainly discrete ponds of standing water, would be highly stagnant. The historical record indicates that water quality did not seem to be a major problem. While travelling with a group of Mandan and Hidatsa on the open plains in summer, Henry observed:

> We suffered much from want of good water; that in the pond was a mere poison to the taste and smell, though the Indians drank it with pleasure. These savage brutes can drink stinking, stagnate water with as good a stomach as if it were spruce beer (in Coues 1965:371).

As water resources diminish, these remaining beaver dam/pond systems would become an even greater focal point for many faunal forms. During drought, even in a large tributary, there would be a contraction and/or reduction of beaver-occupied habitats; and many portions of the waterway may become dry. However, in the above habitats, beaver again would be the crucial factor in reducing the impact of drought, and maintaining surface water in the vicinity of winter camps.

Reduced grassland productivity and diminishing water resources would also provide the impetus for earlier herd movements to the winter range. I have also noted (1979:138) that continued low grassland productivity would bring about conditions unfavorable to bison survival: insufficient food, and a marked increase in the energy needed to acquire these resources. As a result, by the second or at most the third year of a drought cycle, the herds were entering the winter phase in a physically weakened condition, resulting in high mortality. Semple (1970:128) reported that in areas where nomadic grazing is practiced, drought conditions may be so widespread that half or more of the domestic animals may die. Reduced birth rates are also a contributing factor to population decreases. Sarvis (1941:67) notes that when forage supplies are inadequate, the birth rate of cows drops the following season. The marked reduction in bison populations should not have substantially affected the availability of this resource to the resident Plains groups. Diminishing water resources limit suitable habitat to fewer and fewer areas. Therefore, reduced bison populations were balanced by the remaining herds being concentrated around these areas (Morgan 1979:184).

Drawing on the climatic data from the winter of 1987-88 (the second winter of the recent drought), it could be said that the availability of water resources becomes extremely critical. During the months of November and December, when freeze-up usually occurs, only 4.6 cm of snow fell; the norm is 45.0 cm (Environment Canada; Atmospheric Environment Service). Therefore frozen beaver ponds may continue to be a major source of surface water for human populations. Beaver may also keep the primary ponds open for sometime after freeze-up. In November, David Thompson (in Glover 1962:98) observed a beaver house on a river with a few yards of open water, which was kept from freezing by the beaver. As previously noted (chapter II), the exceptionally dry winter of 1987-88 resulted in no spring runoff in Cottonwood Creek, while on the Moose Jaw River discharge flow was negligible - only 0.001 cms. With no soil moisture, grasses remained dormant until the first spring rains; a precarious condition for the already-weakened herds. The absence of snowmelt also meant no local water surpluses. On the summer range the above climatic conditions would be even more severe. Not only would grassland productivity be low, but most areas would be inaccessible due to the absence of surface water resources (Morgan 1979:139). It is inferred that bison migrations to the summer range were suspended. Ecological studies by Maddock (1979) on migratory herds in the Serengeti, a savannah region in East Africa, provide similar parallels in terms of what factors alter, and in some cases suspend migratory movements. Briefly, in this area migratory herds such as wildebeest, zebra, and Thompson's gazelle moved to the plains in the rainy season, and back to the Woodlands in the dry season. Maddock observed that migrations were the means by which these populations could use the plains area, where forage was only available during the wet season. She concluded that:

> The main migratory patterns are thus determined by food supply, which is largely dependent upon rainfall. Yearly

> variations in the migrations are also related to rainfall. Animals use the plains only while there is sufficient rain to produce green grass.... This flexibility is essential in an environment with widely fluctuating rainfall (1979:127).

It is also inferred that at the height of any similar drought in the aboriginal past, major movements by the human populations were also suspended. Localized movements within the Valley Comlex system would be common.

From a general perspective, it is predicted that during a drought cycle, there would be a progressive inward movement of faunal populations, especially beaver and large herbivores, to the main waterway. Historical documentation by Dary (1975:33) hints at ecological conditions of this nature. During the summer of 1868 drought conditions prevailed throughout Kansas and most of the states from Texas to the Dakotas. Water was limited, vegetation was sparse, and most of the small streams had dried up. Only the largest rivers still contained surface water. Vast numbers of bison herds, stretching for thirty miles, were seen converging on the Smoky Hill River, driven there by the lack of water.

Normally beaver contribute little to the direct maintenance and control of water resources on the main waterway. During prolonged drought ecological conditions would change dramatically, as spring runoff would be reduced markedly. There also would be a progressive drop in water levels as water loss accelerated. These conditions, which generally stimulate beaver dam/pond construction on smaller waterways, probably would initiate similar behavior on the main waterway. The availability of surface water combined with vast floodplains providing superior forage, as compared to what was available on the prairie uplands, would result in huge concentrations of large herbivores along the main waterway.

Given these events, the human populations also would have been drawn to the main waterway, during the spring, summer and fall, to hunt bison. Inclement weather would initiate movements back to the larger tributaries, where sheltered areas, and correspondingly firewood, would be available. Likewise, many of the large herbivores would eventually be drawn to the sheltered areas.

The Beaver/Firewood Relationship

It has been noted that on the Plains, limited resources such as surface water resources and treed areas are important habitat requirements for both human and beaver populations. With regard to water resources, beaver contributed significantly to maintaining and conserving these resources, thus appreciably benefiting the associated human populations. With regard to tree/shrub resources, beaver requirements for food/construction, and human needs for firewood, would unavoidably result in a reduction of these resources. In a sense, beaver and man appear to be in direct competition for a limited resource. However, the historical record suggests that the felling of trees by beaver may in actuality provide an important source of firewood and construction materials for the associated human populations.

Historical and ethnographic documentation shows that the "collecting" of firewood was the work of women. Dodge (1959:246) and Kennedy (1961:21) have more specifically noted this to have been the task of older women. Grinnell (1962:185) observed that girls, as soon as they were strong enough, also carried wood and water for their mothers. McGillivray, in discussing the chores of women, including the collection of firewood, also gives insights into their status in aboriginal society:

> They [women] are considered as the Slaves of the men and treated accordingly .... She is obliged to undergo all the drudgery which occurs in the domestic affairs of the family. She is continually employed in drawing water, carrying wood, searching for horses and every kind of employment which the Husband thinks below the dignity of a Warrior or hunter to assist her in, and when she has the misfortune to incur his displeasure for any neglect of duty or want of respect she is certain to experience the brutal effects of his resentment (in Morton 1929:34).

Among the Mandan/Hidatsa (Plains-Village groups) driftwood was the primary source of firewood and construction needs. Charles MacKenzie notes, "Drift wood supplies the villages with fuel, which as well as the timbers for their houses, is dragged home always by the women" (in Masson 1960:Vol.I:338). Catlin, (1973:Vol.I:121), while among the Mandan, also observed that one of the principal occupations of the women of the village was to procure wood and water.

The historical record generally implies that dried wood was the primary source of firewood, with branches, rather than tree trunks, being used primarily (Wissler 1910:31; Henry, in Coues, 1965:724). The most common method of procuring firewood, as in the case of driftwood, was the simple act of gathering. Wissler (1910:31) states that in earlier times stone hammers were used for breaking dry branches. Henry observed several methods of procuring wood among Piegan women:

> The women, who are mere slaves, have much difficulty in collecting firewood. Those who have no axes fasten together the ends of two poles, which two women then hook over dry limbs of large trees, and thus break them off. They also use lines for the same purpose; a woman throws a line seven or eight fathoms long over a dry limb, and jerks it until the limb breaks off. Others again set fire to the roots of large trees, which having burned down, the branches supply a good stock of fuel (in Coues 1965:724).

Wissler (1910:31) suggests that in historic times commercial axes were used for obtaining wood. However, Henry noted that, "The trunk is seldom attacked by those who have axes, as chopping blisters their hands" (in Coues 1965:724). Grinnell (1972) gives a comprehensive analysis of the methods of collecting fire wood among the Cheyenne women:

> During the morning parties of women and young girls started off to get wood, ... When the place was reached where they were to get wood, some gathered the sticks lying on the ground; others climbed up into trees, breaking off and throwing down the dead branches, while those below trimmed and made them ready for the ropes. The wood was divided into even loads, and when all these were prepared, each woman took hers on her back, and, in single file, they set out for the camp... (1972:Vol.I:65).

The above historical documentation strongly implies that a significant amount of the dry wood collected for fuel may be a direct product of beaver activities. My field work, described in chapter IV, will provide some relevant information in support of the historical observations.

According to Grinnell, timber was often used in pound construction:

> The Sik'-si-kau [Blackfoot] built their pis'kuns [pounds] like the Crees, on level ground and usually near timber. A large pen or corral was made of heavy logs about eight feet high (1962:230).

As I shall show in Chapter IV, suitable material can be produced by beaver activity. Among the Plains Cree, Mandelbaum noted:

> The shaman who directed the construction and operation of a pound, chose the site in a thicket; a circular area thirty to forty feet in diameter was cleared. The cut brush and felled logs were heaped up to make a wall ten to fifteen feet high. Loose boughs, interwoven between standing trees, furnished a foundation for the wall (1940:190).

Henry, who claims that the Assiniboine were the most expert of the Plains tribes in running drives, described their pound:

> The common size is from 60 to 100 paces or yards in circumference, and about five feet in height. Trees are cut down, laid upon one another, and interwoven with branches and green twigs...(in Coues 1965:518).

Most of the historical references suggest that the Historic Indians chopped or cut the trees used in pounds. It is true that with the advent of the fur trade, steel axes were a highly prized trade item. However, in earlier times it is hardly likely that stone tools would have been as efficient or necessary, as the trees were already beaver felled and trimmed. In the pursuit of their habitat requirements, beaver provided the human populations with useable sources of firewood and construction materials.

The Beaver: World View and Ideological Systems

The non-hunting of beaver by Plains Indians has its closest parallel in the sacred cow of India. Harris has strongly stressed the ecological adaptiveness of taboos, and he points out that:

> The case of the sacred cow of India conforms to the general theory that the flesh of certain animals becomes very expensive as a result of ecological changes... . With the rise of the state and of dense rural and urban populations, however cattle could no longer be raised in sufficient numbers to be used both as a source of meat and as the principal source of traction power for pulling plows 1985:459).

Harris (1985:459) concluded that value of the cattle as traction power, and the importance of its dung as fuel, etc., greatly outweighed its value as food, therefore they had to be protected. The result was that the Hindu religion began to stress that it was a sacred duty to refrain from killing cattle or eating beef. There were avenues through which the taboo could be circumvented. Harris (1985:460) observed that despite the ban on slaughter, the Hindu farmers culled their herds, and adjusted sex ratios indirectly through various forms of neglect. In addition, cattle that die a natural death could be eaten by certain outcastes.

In a roughly similar fashion, the value of beaver in conserving and maintaining a critical resource (i.e., surface water resources), and in providing a major source of firewood and construction materials would have far outweighed its value as a food resource. Low beaver populations also acted against its use as a food source.

The importance of the beaver in the ideological systems of the Plains peoples has been noted by many investigators. According to Dugmore (1914:178-179) some tribes believe that the world was originally made by giant beaver; while other groups claim descent from beaver. Among the Blackfoot, the beaver bundle was the most sacred ceremony (Dugmore 1914:179; Wissler 1912:168-169). Ewers notes that among the Blackfoot, "the most important of these animal cults in dog days was that of the beaver, for it was the beaver medicine men whose rituals charmed the buffalo into the corral and brought food to their people in time of need" (1958:17). Ethnographers (Ewers 1955:32; Lancaster 1966:188) also observed that the religious beliefs associated with beaver suggest a prohibition against the killing of beaver. Grinnell (1972:104) not only implied a prohibition against the killing of beaver among the Cheyenne, but that it was reverenced for its abilities to maintain surface water.

In addition to the restriction against the killing of the beaver, there also appears to have been a taboo against the consumption of beaver flesh. The myth surrounding the name of one of the divisions or clans of the Northern Cheyenne, "closed gullet", refers to the "killing by a man of a medicine beaver, the eating of which caused all who partook of it to choke and thereafter made the flesh of the beaver, a beaver-skin, or anything pertaining to a beaver, taboo to these people and to their descendents" (Grinnell 1972:Vol.1:94). As previously noted, a similar taboo was observed by Peter Fidler while he was travelling with a group of Indians, mainly Blackfeet and Piegan.

> These Indians are very little acquainted with killing the Beaver in their houses... several of them are so full of superstition as even not to touch one and a great many of them will neither eat of them nor suffer one of them to be brought to their tents (in Nelson 1973:171).

The means by which a beaver bundle is acquired also reinforced a cultural control against the killing of beaver. Curtis (1970:Vol.6:69) has established that the various skins and objects in a beaver bundle can only be acquired by purchase, as the Indians were not allowed to kill the animals. Similarly, as observed by Harris for the sacred cow, the prohibition does not appear to be absolute or it can be circumvented. Lancaster notes that, "On occasion the Blackfoots would take the pelt of an Underwater Person [Beaver] for employment in religious ritual, but they did not trap beaver on a commercial basis" (1966:188). The Blackfoot also apparently had no aversion to trading beaver pelts trapped by other groups. Lancaster observed that:

> ...those beaver pelts that were brought in by the Blackfoots for purposes of trade with the White Man invariably had been captured from White trappers or from the Crees or from other tribes that had no religious prohibitions with regard to trapping the Underwater Persons (1966:188).

Ethnographic sources show that the myths surrounding beaver bundles reinforced the aversion to beaver hunting. Briefly, according to a Piegan version (presented in Curtis 1970:Vol.VI:70-71), there was a man who killed every kind of animal to obtain skins for his medicine bundle so that his medicine would be powerful. One summer he was camped by a stream in which there was a beaver dam. He immediately decided to obtain a beaver skin as he did not yet have one in his bundle. The old beaver, having supernatural powers, became aware of his intentions and was angered. As revenge, he persuaded the man's wife to come live with him in his lodge. The man was so unhappy about his wife's disappearance that the beaver finally relented. He sent the wife and the young beaver, her son, back, stating that if her husband treated the child with kindness he would give him a gift. The husband accepted the child, and the beaver gave him the gift of the tobacco plant.

The above myth and a Blood version (Wissler and Duvall 1908:75-76) stress adverse repercussions, if beaver are destroyed or harmed. Another Piegan interpretation of the above myth, as documented by Wissler and Duvall (1908:77-78), emphasizes the role of the beaver as a protector or guardian of human life.

Summary and Conclusions

Surface water is the crucial limiting factor in the Plains environment. Beaver, through the storehouse effect of their dam/pond systems, not only conserve these resources, but secure them in specific geographic locals. It is this latter condition that particularly enhanced the survival potential for early human populations. As these were a pedestrian peoples with limited mobility, the recognition of these beaver-occupied areas would have been a crucial factor in their settlement and movement patterns.

Environmental knowledge, as the most effective component of hunter/gatherer strategies, has been the underlying theme of this study. An awareness of the beaver's abilities to secure and stabilize surface water allowed for the repetitive use of an area. Familiarity with an area meant that the spatial location of essential resources and their abundance could be determined. Ewers observed that:

> The Blackfoot had knowledge of the locations of all running streams, clear lakes, and springs in and near their hunting grounds that afforded clean drinking water for themselves and their dogs (1955:40).

In an area subjected to pronounced macroclimatic fluctuations, and in which resources were unevenly distributed, familiarity with an area was very important to a peoples with limited mobility. Treshow notes that, "Familiarity and predictability are vital to the maximum utilization of an environment". (1976:102). He goes on to state that, "Hunting success .... is predicated upon detailed knowledge of the area being hunted. It is likely that hunting success for both humans and animals is inversely proportional to the distance from the familiar range" (1976:98).

More specifically, beaver habitat requirements are most frequently met on large tributaries, so that they should reach their highest densities on these waterways. Likewise for human populations, the larger tributaries most frequently provide the ideal wintering conditions: sufficient surface water resources in proximity to shelter, and correspondingly to firewood. All these resources are appreciably enhanced directly, and indirectly, by the presence of beaver. Beaver not only conserve and maintain surface water, but by felling tree/shrub species provide firewood and construction materials. Beaver dam/pond systems also attract a wide range of faunal forms, which serve as alternate food resources. Parallel needs thus placed man and beaver in a close association; man, for the most part, being the beneficiary. This kind of relationship is defined as commensalism, "in which one population is benefited but the other is not affected" (Odum 1959:225).

Environmental knowledge also extended to an intimate understanding of bison behavior, and the cause/effect attributes of Indian uses of prescribed fire. Through the use of fire the Plains occupants were able to maintain herds in the vicinity of the wintering areas both in fall and spring. Through their knowledge of bison behavior the Plains groups were able to manipulate the herds to the drive sites with a minimum of disruptions and/or disturbances. The remaining herds thus stayed in the vicinity of the residential base, available for subsequent hunts - an important survival factor for pedestrian peoples.

Given the above, it was estimated that human occupancy of the winter range could be from 8 to 9 months during average climatic conditions. On the summer range, again, through the burning of the prairies herds could be attracted to select areas where traditional hunting techniques could be continued. Human occupancy of the summer range has been estimated at approximately three to three and one-half months.

In my earlier research, I concluded that, given the abilities of the Plains groups to manipulate and thus stabilize essential resources under normal climatic conditions, the following conditions were made possible: (a) the continuation of traditional hunting techniques during most of the year; (b) with the exception of major movements between the summer and winter range, a relatively sedentary existence; and (c) the group size necessary to operate a drive effectively could be maintained on a year-long basis (Morgan 1979:183).

During a drought cycle there would be a progressive dependency on the winter range for essential resources. The human population may have been forced eventually to remain within the Valley Comlex system on a year-round basis. Many beaver dam/pond systems would collapse; however, human populations, because of repetitive use of these areas, would have been aware of the location of the remaining viable beaver ponds. These oases of water and greenery, with their focal beaver lodge, must have impacted strongly on the resident Plains Indians. Their ideological systems (more specifically myths) portray the beaver as a protector of human life. They also imply adverse repercussions if beaver are harmed or killed. Thus there is a religious reinforcement of the ecological basis underlying the non-hunting of beaver resources.

During drought, bison populations would have undergone high mortality rates; however, diminishing water resources would restrict suitable habitat to fewer and fewer areas. Since it was also suggested that bison herds suspended their migrations during intense drought, herd densities in the Valley Comlexes would be high. In other words, there is no evidence that the Plains groups occupying the Valley Comlex systems would experience a scarcity of resources. In fact, given the year-round commitment to residency within the Valley Comlex system (a marked increase in sedentarianism), the energy output in procurement of essential resources would actually have been reduced.

In summary, during a drought cycle, beaver conservation of surface water resources would have been crucial to the survival of the Plains peoples. The presence of the remaining surface water resources in the Valley Comlex systems can be directly attributed to beaver activities. In the absence of beaver colonies, human occupancy of the Plains may not have been possible during periods of intense drought.

On the Plains low beaver populations, combined with a highly visible and stationary lifestyle, make beaver very susceptible to human overkill. Thompson, (in Glover 1962:95) in the historic period, alluded to the beaver's stationary lifestyle as a factor in its susceptibility to hunting pressures. Low beaver populations could be attributed to two factors: (a) suitable habitats were restricted to specific areas; and (b) these habitats could not support high beaver densities. On the small/medium-sized tributaries limited surface water would have restricted beaver population size. On the main waterway (e.g.,Qu"Appelle River) because of food limitations, overall beaver populations were only 0.61 colonies/river km (Sherratt & Hatch 1977). The larger tributaries generally supported the highest densities. For example, the overall average density of beaver populations on Pheasant Creek, a large tributary of the Qu'Appelle River, was 1.0 lodges/river km (Beaver Cache Survey, Oct. 22, 1979). Ray (1976) made similar observations for several fur-bearers in the Parkland, including beaver, noting:

> ...since their habitats were concentrated in a few areas, these animals were quickly discovered and destroyed, and by the 1820s they had been largely exterminated from the middle and upper portions of the Assiniboine River valley (1976:118).

The nature of traditional hunting techniques (historically documented among

Woodland groups), prior to the advent of the fur trade and the introduction of steel axes, would also have acted against even limited use of beaver as a food and/or fur source. According to Denys (1908:429) and Thompson (in Glover 1962:152), the commonest way to hunt beaver in summer was to break their dams and drain their ponds, so that the beaver became easy prey. It is highly unlikely that the Plains occupants would have destabilized the beaver dam/pond networks so crucial for maintaining surface water resources for, at best, a limited food supply.

One can conclude from this study that the aversion to beaver hunting evolved from its importance in maintaining and stabilizing surface water, a critically limited resource on the Plains. In addition, beaver activities provided firewood and construction materials. Beaver dam/pond systems also attracted a wide range of animals that provided alternate food supplies. The aversion to beaver hunting was reinforced by the fact that beaver were highly vulnerable to human overkill. Susceptibility to hunting pressures stemmed from two conditions: a highly visible and stationary lifestyle; and being restricted to select areas that could only tolerate low population densities. Also traditional beaver hunting techniques could have contributed to the reduction and destabilization of surface water.

THE WOODLANDS

Man/Beaver Relationships

The focus in this study is on the importance of beaver in the hunting/gathering strategies of the Woodlands groups. As compared to the Plains, the food resources are more diversified, and generally dispersed. Given the extent of the area involved, there are internal variations in the resource base; and correspondingly differences among the various aboriginal groups in the kind of basic foods used. In 1804, while a fur trader among the Saulteux, Peter Grant observed:

> The original, or moose deer, are seldom found in large droves like the elk or buffaloe, but are generally scattered in small bands, which frequent the thickest wood, and feed upon the tender branches of the willow, birch or poplar. ... The size of the animal, its skin and meat, which is of the most excellent quality, make the hunting of it an object of the first consequence with the Natives; it may, indeed, be reckoned their staff of life, and a scarcity of moose in the winter season is sure to cause a very severe famine (in Masson 1960:Vol.II:341).

Grant also noted that beaver and bear were considered an important food source; however, animals such as otters, cats, fishers, martens, muskrats, etc., were hunted only for their furs (in Masson 1960:345). Skinner (1911:134) similarly found that among the Northern Saulteaux, the moose was the most important food source. He lists a range of other animals that were eaten including caribou, Virginia deer, bear, lynx, beaver, and muskrat.

The forested area north of the Saskatchewan is defined by Thompson (in Glover 1962:91) as "Muskrat Country"; the home of the Nahathaway Indians [Woodland Cree]. He also singled out the moose as their most important food source, noting, "The flesh of a Moose in good condition, contains more nourishment then that of any other Deer" (in Glover 1962:84). Other animals listed by Thompson as food sources include Reindeer [caribou], bear, and beaver. Thompson implies, however, that prior to the acquisition of trade metal goods, the Indians were not able to hunt the beaver effectively (in Glover 1965:152). Skinner (1911:25) suggests that the rabbit or hare was the most important source of food for the Woodland Cree. Referencing the historical record, Rogers (1963:32-33) notes that in earlier times the hunting of large mammals by the Mistassini Cree was their major occupation, particularly during autumn and winter. Fur-bearers, grouse, and waterfowl provided a supplement to the diet. Beaver, which he classed as big game along with bear, caribou, and moose, were an important part of the diet. Referring to Skinner, Rogers (1963:32) suggests that rabbits were taken during periods when large game was not available.

Harmon (in Lamb 1957:209), a fur trader, observed that the large game animals were hunted mainly for their meat, principally when they are fattest, during fall and winter. Ray (1976:27) also notes that in the Woodlands region only two large game species were found: woodland caribou and moose. Small game, however, was abundant, with the muskrat and beaver being considered significant sources of food; cub beaver was considered a delicacy. Fishing was considered important by all of the groups noted above (Skinner 1911:27; Grant, in Masson 1960:Vol.II:345; Rogers 1963:33).

Some of the animals were exploited more heavily during specific seasons. Large game, particularly moose, is hunted mainly in winter (Skinner 1911:27; Rogers 1963:32; Hennepin 1880:318). Beaver appeared to be hunted most frequently in spring and fall (Grant, in Masson 1960:Vol.II:343-344; Hennepin 1880:318). Ray (1976:46) suggests a seasonal use of different environmental zones for the Woodland Cree and certain bands of the Assiniboine. The tribal bands spent the warm months (March, April, and May) in the forest fishing and hunting along the shores of lakes and rivers. In August, September, and October they hunted in wooded areas adjacent to the prairies, taking moose and trapping beaver. From November to March they moved into the parkland to hunt bison and trap wolves. Ray's subsistence pattern for the Woodland Cree and Assiniboine would be best considered as a manifestation of the historic period, at the time when the Cree were advancing into the Saskatchewan Plains, and were exhibiting a mixture of Plains and Woodland traits; e.g., trapping beaver (a Woodlands trait), and pounding bison (a Plains trait).

More specifically, the following analysis will attempt to determine the degree of beaver exploitation, and the hunting strategies used by the Woodlands groups. Thompson provides a perspective on beaver/man relationships with conditions that existed prior to contact:

> ... the Beaver, they were safe from every animal but Man, and the Wolverine. ... and except the Great Lakes, ... occupied all the waters of the northern part of the Continent. Every River where the current was moderate and sufficiently deep, the banks at the water edge were

> occupied by their houses. To every small Lake, and all the Ponds they built Dams, and enlarged and deepened them to the height of the dams. Even to grounds occasionally overflowed, by heavy rains, they also made dams, and made them permanent Ponds, and as they heightened the dams [they] increased the extent and added to the depth of the water; ... . Small Streams were dammed across and Ponds formed; the dry land with the dominions of Man contracted, everywhere he was hemmed in by water without the power of preventing it: he could not diminish the numbers half so fast as they multiplied, and their houses were proof against his pointed stake, and his arrows could seldom pierce their skins (in Glover 1962:151-152).

Thompson goes on to state that the acquisition of metal trade goods shifted, so to say, the balance of power; and allowed the Natives to hunt the beaver more efficiently:

> For the furrs which the Natives traded, they procured from the French Axes, Chissels, Knives, Spears and other articles of iron, ... Thus armed the houses of the Beavers were pierced through, the Dams cut through, and the water of the Ponds lowered, or wholly run off, and the houses of the Beaver and their Borrows laid dry, by which means they became an easy prey to the Hunter (in Glover 1962:152).

Thompson's statement that beaver had few natural predators is generally not disputed by contemporary authors. Rutherford (1964:14) similarly noted that the beaver had few natural predators. Seton (1953) lists several animals that are capable of attacking the beaver, e.g. otter, wolverine, black bear, etc; but admits that these predators had little impact on beaver populations (1953:493).

No one would disagree that prior to the advent of the fur trade beaver were abundant in the Woodlands; nor would there be any argument, particularly in contemporary times, as to the beaver's ability to inundate large areas. Thompson, however, underestimates the ability of earlier peoples to hunt beaver effectively, or better put, to alter their environment significantly.

> The following historical descriptions give hints on beaver hunting techniques that may have been used prior to contact. Denys' information on beaver hunting techniques comes from his association with the Micmac Indians of the Eastern Woodlands. He notes also that hunting techniques varied considerably during different seasons. In summer the most common way to hunt beaver:...was to break their

> dam, and make them lose the water. Then the Beavers found themselves without water, and did not know any more where to go; their houses showed everywhere. The Indians took them with blows of arrows and of spears; and, having a sufficiency, they left all the rest (1908:429).

Beaver were hunted with arrows when they took to the woods.

According to Denys (1908), in winter, beaver hunting was assisted by the use of dogs, which located the houses containing the beaver. The Indians made a hole in the ice in front of the house, and another one up to 30 paces away. At the latter hole an Indian stood with a bow and arrow tipped with a harpoon, (a cord was attached at one end). At the other hole, an Indian reached through the opening into the Beaver House to find the Beaver. Stroking them gently he found the tail, and pulled the beaver onto the ice, and killed it. It was possible to remove three to four in this manner before the rest took flight. Not being able to breathe, they attempted to surface through the other hole at which they were harpooned (Denys 1908:429-430).

Skinner (1911:25) also discusses winter hunting techniques for the Eastern Cree, noting that the creek in which the beaver lay was shut up by rows of stakes driven through the ice to the bottom of the stream along the banks above and below the houses. The houses were broken from above. Some beaver were caught, but others escaped; and finding the stakes passed along them until they reached an opening covered with a net. When the Indian felt one struggling, he drew the net tight, catching the beaver. When beaver holes (burrows) were found in the bank, they were blocked up, and the beaver dug out.

There are some differences from Denys in Skinner's descriptions of beaver hunting. He notes that the beaver attempt to escape from the lodge to their burrows. Denys does not address this problem. Skinner also notes that the lodge and burrows were broken into, while Denys does not indicate this procedure as part of the hunt. Thompson (in Glover 1962:153:52) gives a clearer picture of some of the problems of winter hunting, even when iron tools were available. He notes that the surest way was to stake up the doorway of the house; but the beaver could hear the approach, and escape to their burrows. Some hunters first preferred to find the burrows and close them up with stakes, and then stake the house. He also notes that dogs were used to locate the beaver in the house and burrows; then with the axe and chisel, the house or burrow was broken into. The beaver were killed with the ice chisel. Thompson's earlier description of the breaking of dams and draining of ponds parallels closely Denys' description of summer hunting of beaver, prior to contact.

Hennepin (1880) provides additional information on beaver hunting from his experiences among the Sioux in Minnesota in 1680. His description of beaver hunting in winter also entails the breaking of the lodge, and the ice around it (1880:320-321). In this case, the net was placed directly over the lodge entrance in order to trap the beaver. His description is important in that it stresses how labor intensive beaver hunting is in winter:

> ...because there is often a foot of earth and wood to be broken and cut by blows of the axe, the whole being frozen as hard as stone... . They labor with the same force, often from morning to night, without taking anything. Sometimes they catch only three or four (1880:321).

Henry's description of beaver hunting among the Chippewa (1969:125) similarly notes that during winter the most frequent method of taking the beaver was by breaking its house with trenching tools [chisels]. He also observed that the beaver might escape to their burrows, but claims they were drawn out with the hands. This is the only other reference, besides Denys, to this method of capturing beaver. In 1804, Grant (in Masson 1960:Vol.II:342) noted that in fall, among the Saulteux, beaver were taken with steel traps set under the water. He goes on to state that:

> The most simple method, however, is by destroying these houses, and draining the pond on which they are situated, so that the animals, being alarmed and deprived of the water so necessary to their existence, take immediately to flight and become an easy prey to the hunters,... (in Masson 1960:Vol.II:342).

In earlier times the hunting of beaver entailed the taking of the whole colony. Denys notes that in winter:

> Few in a house are saved; they would take all. The disposition of the Indians is not to spare the little ones any more than the big ones (1908:432).

Thompson also observed that:

> ... not one escapes, but all [are killed] with hard labor: Such was the manner of killing the Beaver until the introduction of Steel Traps, which baited with Castorum soon brought on the almost total destruction of these numerous and sagacious animals (in Glover 1962:154).

The taking of the whole colony made good economic sense. The effort expended in the hunting of beaver, particularly in winter, could only be compensated by the greatest return in food. The killing of all beaver in a lodge also made good ecological sense. The breaking of the lodges and burrows in winter would have exposed the remaining beaver to winter's inclement weather, and it is highly likely that they would have died from exposure. In addition, with their lodges broken, the beaver would be highly susceptible to predation.

The previous descriptions suggest that prior to the use of steel traps, baited with Castorum which, according to Thompson (in Glover 1965:156), had an addictive effect on beaver, there is little evidence that traditional hunting techniques changed markedly during the historic period. The hunting of beaver in winter continued to be labor intensive. The acquisition of the chisel and hatchet to break lodges (Ray 1976:92) appears to be the only major addition. However, prior to contact, the Indians were able to draw beaver from the lodge without the need to break them. The most effective way to break the ice, even in historic times, continued to be wooden tools such as axe handles and poles (Hennepin 1880:320). The gun is also ineffective at such close quarters. Daniel Harmon (in Lamb 1957:209), a fur trader, noted that when the Indians broke into the lodges they speared the beaver. Spring/summer/fall hunting techniques also did not undergo major changes. The breaking of dams and draining ponds was still the most effective and productive method of accessing beaver resources. The gun, also, was used more frequently during this time of the year.

Although the historic record tends to emphasize the hunting of beaver in winter, the question to be asked is whether this truly was the case in earlier times. In the historic period the intensive hunting of beaver was generated by its value as a fur-bearing animal. Henry [the elder] (1969:125) implied that winter hunting of beaver was tied to the fact that the fur was most valuable at that time of the year. Harmon notes that, "From the month of June, until the latter end of September, all animals have but little fur; and therefore, at this season, the Indians do not hunt them much" (in Lamb 1957:209). However, prior to the fur trade period, the intensity of beaver hunting was determined by food needs, which exceeded fur needs. Denys noted:

> They killed animals only in proportion as they had need of them.... They never made an accumulation of skins of Moose, Beaver, Otter, or others, but only so far as they needed them for personal use. They left the remainder where the animals had been killed, not taking the trouble to bring them to their camps (1908:426).

The historical record also implies that large mammals such as moose were the important source of food in winter. Considering how labor intensive the hunting of beaver was at this time, it is suggested that it was mainly a supplement to the diet, particularly when the larger mammals were scarce. In the historic period, furs, as the medium through which trade goods were obtained, began to replace food as the important priority. Beaver meat, rather than beaver pelts, was now the surplus.

Interestingly, using traditional hunting methods, with only the addition of the chisel and hatchet, and the occasional use of the gun, the beaver populations were markedly reduced. Thompson (in Glover 1962:156) observed that steel traps were not introduced to the hunting of beaver till 1797. Ray (1976:118) notes that in 1795 tne Cumberland House Journals indicated that the lands around the post had been trapped out for a number of years. In territories to the east, fur bearing species had been eliminated even earlier. In other words, traditional beaver hunting techniques were highly effective, and could have significantly affected beaver populations when employed intensively. This did not occur, Although the historic record tends to emphasize the hunting of beaver in winter, the question to be asked is whether this truly was the case in earlier times. In the historic period the intensive hunting of beaver was generated by its value as a fur-bearing animal. Henry [the elder] (1969:125) implied that winter hunting of beaver was tied to the fact that the fur was most valuable at that time of the year. Harmon notes that, "From the month of June, until the latter end of September, all animals have but little fur; and therefore, at this season, the Indians do not hunt them much" (in Lamb 1957:209). However, prior to the fur trade period, the intensity of beaver hunting was determined by food needs, which exceeded fur needs. Denys noted:

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> "The whole right bank of the great river [Winnipeg] as you go down from the Lake of the Woods as far as Lake Winnipeg is held by the Cree, and it is the country of the moose and marten, while beaver is so plentiful that the savages place little value on it and only collect the large skins which they send to the English. These people dress themselves in winter in beaver skins and in spring they throw them away, not being able to sell them (in Burpee 1927:59).

An overabundance of beaver and the consequences of their activities (i.e., floodings) are also major factors to contend with in contemporary times. In Elk Island National Park, from the time the beaver were introduced to the present, there has been an exponential growth in their populations (Blyth and Hudson 1987:142-154). In the Wood Bison area of Elk Island Park, because of beaver activities, the area covered by water has increased from 2 to 9%; and sedge cover has been reduced by 3% (Olsen 1987:33). These changes brought about a marked reduction in ungulate food sources. Knudson (1962: 8-9) also noted that the inundation of low-lying areas and or floodplains brings about the destruction of species such as willow,and alder which are important browse sources for many game animals. The anaerobic and/or toxic conditions associated with long-standing beaver ponds (Knudson 1962:14) generally prevented riparian tree/shrub species from re-establishing.

On a larger scale, on the Kabetogama Peninsula in northern Minnesota (Naiman et al 1988:757), over a period of the years 1940-1986, beaver increased their habitat use from 71 dams to 835 dams. Less then 1% of the peninsula was impounded in 1940, as compared to 13% in 1986. The rapid increases in beaver populations were attributed to extensive fires and logging at the turn of the century, resulting in a large supply of aspen; and the scarcity of predatory wolves. As previously discussed, there is no evidence that predation markedly affects beaver populations. From the long term perspective, large scale forest fires, by increasing aspen growth, would bring the beaver back to the area.

More important, Naimen et al (1988) have pointed out that our contemporary perspectives of the successional pathways associated with beaver activities must be reconsidered. They state:

> ... we envisioned that beaver built dams on a stream and through time the ponds age, are abandoned, meadows form and mature, and eventually a stream is reformed as a new channel is cut... .. In the boreal forests of northern Minnesota, Quebec, and Alaska, however, we see a complex pattern that may involve the formation of emergent marshes, bogs, and forested wetlands, which appear to persist in a somewhat stable condition for centuries (Naiman et al 1988:761).

In other words, the beaver dam/pond networks are highly resistant to environmental perturbations. I am suggesting that the reason the above successional pattern no longer appears operative is because of two factors: (a) the control of natural fires in contemporary times; and (b) the discontinuance of traditional burning practices by aboriginal peoples.

The propensity for beaver to inundate large areas, with the consequences of the food resources of large ungulates being markedly reduced, must have been highly problematic for the early aboriginal people. However, as has been frequently stressed in this study, environmental knowledge was undoubtedly the most important aspect of hunting and gathering subsistence strategies. The focus here is to examine how Woodlands groups applied their knowledge of fire ecology to manipulate and regulate their immediate environments, and more specifically, to control beaver populations and create habitats for a range of faunal forms.

Lewis' ethnographic studies among the Indians of Northern Alberta brought into focus the importance of fire technology in their hunting/gathering subsistence strategies. He notes:

> ... prescribed fires were once part of the Indian's own pattern of "landscape management" ... their selective employment of fire for boreal forest adaptations indicated an understanding of both the general principles and the local specific environmental relationships that are the subject of modern fire ecology (1982a:17).

In addition, Indian burning patterns were diverse, including not only fire "yards" composed of meadows and small forest openings, but also fire "corridors", which included traplines, trails, streams, and lakesides (Lewis and Ferguson 1988:73). Lewis found that fire is used "... to increase both the diversity and productivity of plants and animals" (1982a:19). More specifically, he observed that the early growth of grasses on burned meadows attracted game, e.g., moose, making hunting much easier (1982a:28).

The creation of beaver meadows is a sophisticated expression of traditional environment knowledge. The breaking of dams and the draining of ponds serves a dual purpose: it is an effective beaver hunting technique; and it provides the initial phase in the process of creating a beaver meadow. Beaver meadows have special attributes that make them easy to maintain. Mature beaver ponds that become meadows are especially resistant to tree/shrub invasion, because of the toxic quality of the soils caused by the previous impoundment of the area. The inhibiting effect may persist for up to ten years. The eventual reoccupation of the area is usually by willow and alder, important sources of browse for ungulates. The question is how to prevent beaver from reoccupying the area. The answer lies in the use of fire. One of Lewis' Woodland Cree informants gives important clues as to the effect of fire on beaver populations.

> As for the beaver, it takes a while before they move into an area that was burned; about four years after the burn. The reasons why it takes that long for the beaver to come to those places is that the aspen don't grow as fast (1982a:31).

The above quote implies that the trees remaining in a burned area were not being utilized by beaver. In fact there may be an avoidance of trees on which the lower trunks had been singed or charred. Therefore, to keep the beaver out of an area, the aboriginal peoples would need only to fire the peripheries of the meadows, about once every three to four years, to keep the new growth aspen from maturing. Large-scale fires would also eliminate beaver from the affected area. Similarly, it would require at least four years before the beaver could begin to reoccupy the area. There would also be a significant gap before prefire conditions would be reached, allowing sufficient time for beaver meadows to become established. However, large uncontrolled fires would actually be detrimental to the aboriginal peoples in the vicinity. Small-scale prescribed fires concentrate herbivores into specific areas, thus facilitating their hunting. Large scale fires would have the opposite effect. A large fire would bring a vegetative uniformity to the affected area, with grassland/shrub areas being the predominant component. As a result, with a marked increase in suitable habitat, the large ungulates, e.g., moose, would be dispersed.

In contemporary times the control of natural fires, and a marked reduction in prescribed firing by Northern natives, has resulted in many of these open grassland areas reverting to forest. Lewis (1982:24) notes that his informants pointed out that if meadows were not burned, periodically they would be taken over by forest. More specifically, one of his Cree informants from Fort Vermilion stated:

> Country was a lot more open then and wasn't so hard to travel. Not like now. You can hardly travel in the bush and it's not so good for hunting. I haven't been on trapline in a long time now. So much brush you can hardly get through (in Lewis 1982a:26).

Beaver/Firewood Relationships

Although associated with a different environment zone, in this case the Woodlands, aboriginal women continued to carry out much the same chores, including the collection of firewood. According to Alexander Mackenzie, among the Woodland Cree, the women, "...dress the leather, make the clothes and shoes, weave the nets, collect wood, erect the tents, fetch water, and perform every culinary service..." (1802:68) Skinner (1911:33) and Hood (1967:8) similarly observed that among the Northern Cree the task of collecting firewood was done by women, while Denys notes that among the Micmac firewood was collected by women and girls, and was of two types.

> They [the women] went to the woods to fetch dry fuel, which did not smoke, for warming and for burning in the wigwam. Any other kind of wood was good for the kettle, since that was always outside the wigwam (1908:423).

Skinner (1911:33) noted that fire was carried about for days smouldering in birch punk. Punk is the dry underbark of a dead tree, which was kept dry to be used as kindling while travelling. The need to carry fire and dry kindling, and the differentiation of dry wood from damp wet wood, points to a paradox peculiar to the Woodlands; whereas, tree/shrub species may be abundant, dry firewood is not. Higher rainfall, lower temperatures, and a heavy canopy results in a pervading dampness in the forest understory. Consequently, these conditions substantially reduce the importance of beaver activities as a source of dry firewood.

Lewis observed that dry firewood was often obtained by deliberate burning:

> ...burning took place in spring. The trees preferred were aspen, though burnt willows were regularly used for kindling. If possible, enough wood was burned to last through the summer and winter months. Much wood was to be found at the edge of meadows where repeated spring burns would scar and subsequently kill a few trees (1982a:37).

The trunks of beaver cut trees were probably the raw materials used in the construction of their wooden kettles. Denys notes that:

> they took the butt of a huge tree which had fallen; not having tools fitted for that, nor had they the means to transport it; they had them ready made in nearly all the places to which they went (1908:402).

Summary and Conclusions

The Woodlands groups occupied a vast area that provided a variety of game animals which, with the exception of the caribou, were generally dispersed. The moose was the most important food source, and was mainly hunted in winter. Through their knowledge of animal behaviour and fire ecology, the Woodlands groups created browse and graze areas that not only provided additional food resources for the large game animals, but concentrated them into specific areas, greatly facilitating hunting strategies. The beaver also ranked high as a significant part of the diet, and also was a source for clothing.

There were seasonal variations in beaver hunting techniques. During the fall and spring, when beaver were most frequently hunted, the simplest technique was to break the dams and drain the ponds. The beaver were thus exposed and easily taken. Winter hunting techniques were highly labour intensive, with a good return not always predictable. In earlier times the hunting of beaver in winter was probably carried out when large game were scarce. The emphasis on beaver hunting in winter during the historic period was related to the fact that its pelt was most valuable at that season.

The historical record clearly indicates that traditional hunting techniques could have significantly affected beaver populations when employed. Long before the introduction of the steel trap, beaver populations had been eliminated from many areas. This did not occur in earlier times because the demand on beaver primarily as food did not exceed supply. It was during the historic period that fur needs, to procure trade goods, exceeded food demands and supply, setting the stage for the destruction of the beaver.

It is also implied that prior to contact the Woodland Indians may have been faced with an overabundance of beaver populations. With no important natural predators, unchecked beaver populations would have had a marked effect on the environment, and consequently on the associated human populations. In contemporary times, mainly because of the control of natural fires, beaver are progressively inundating low-lying areas containing browse and graze species (willow, grass, and sedges), which are important sources of food for game animals such as moose. Prior to contact, changes of this nature, resulting in the dispersal of the large game animals, would have been problematic. For the aboriginal peoples a scarcity of game in winter is particularly precarious because mobility is reduced. Through their knowledge of animal behaviour and fire ecology, they were able to come up with an effective solution. The creation of beaver meadows not only provided grassland areas that attracted the game animals, but also provided an effective means to control beaver populations. The breaking of beaver dams and the draining of their ponds served a dual purpose: (a) it was an effective technique for beaver hunting; and (b) it provided the initial phase in the creation of beaver meadows. Beaver meadows also have special attributes which facilitate easy maintenance. Their soils are toxic to tree/shrub species; the inhibiting effect lasts up to 10 years. The trees that first invade the meadows are important browse species such as willow and alder. To prevent the beaver from reoccupying the areas it would be necessary only to fire the peripheries of the meadow, every three to four years, to prevent new growth of aspen.

In summary, on the Plains, beaver populations were low; and to the aboriginal peoples the beaver was important in maintaining a scarce resource, surface water. In contrast, in the Woodlands, the aboriginal groups were faced with an overabundance of beaver populations. In this environment beaver maintenance of surface water had a detrimental effect, as the flooding of browse/graze areas effectively dispersed the large game animals upon which the Woodlands groups were dependent for food.

To conclude, we can hypothesize that for the early Plains occupants surface water seems to be not only a critical limiting factor, but subject to marked fluctuations in availability. This hypothesis needs to be tested in a specific region of the Northern Plains, and in particular one in which the following specific information can be acquired to "fine tune" this general proposition:
(1) beaver ecology: past and present populations of beaver;
(2) early contact peoples: historical data prior to the fully developed equestrian bison hunting tradition;
(3) prehistoric settlement: existing or newly recovered data from the archaeological record.

The above data will be examined to test the hypothesis of the importance of standing water, especially through the agency of beaver activities. This will be done in the next three chapters, following which a more comprehensive model will be presented. From this

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I will explain the differences in responses of the various equestrian Northern Plains tribes to the changing and/or developing dynamics of the Historic period, based on their history vis-a-vis the beaver prior to contact.

CHAPTER IV

THE ECOLOGICAL EVIDENCE

INTRODUCTION

The main objective of this chapter is to test the primary hypothesis that the historical-recorded non-hunting of beaver by early Plains occupants was mainly a response to the limited availability of surface water and their awareness of the beaver's role in maintaining and stabilizing this resource. A corollary to the above hypothesis states that, given their low populations and a highly visible and stationary lifestyle, beaver are highly susceptible to overkill, another reason for the prohibition on beaver hunting. However, it was also observed that the perceived stability within the Valley Complex is not uniform particularly in relation to surface water supplies. It is therefore more specifically proposed that this factor combined with the spatial relationship between essential resources, i.e., proximity of surface water supplies to tree/shrub areas and shelter, points to the larger tributaries as providing the most favorable habitat conditions for human and/or beaver populations. The second objective of this chapter is to refine the primary hypothesis through contemporary observations of beaver activities and effects, in order to develop a more rigorous model of human-beaver relationships in the context of pedestrian bison-hunters of the pre-contact Northern Plains.

In order to test the above propositions, research areas associated with different size tributaries were selected for analysis. The focus of the analysis, however, was to determine how and to what extent beaver, through the storehouse effect of their dam/pond systems, were able to maintain surface water supplies, particularly during drought, in the different waterways.

To define more precisely the contrasts and similarities between woodland and plains ecosystems, and the resulting effects on man/beaver relationships, field research was also carried out in Elk Island National Park. This area is categorized by Blyth and

Hudson (1987:25) as part of the Parkland-Boreal Forest transitional zone.

REVIEW OF THE LITERATURE

Since the study of beaver behavior required a broad comprehensive perspective, encompassing both Plains and Woodland environs, a review of the available literature was undertaken to supplement the field research. Prior to the arrival of the European, beaver had an extensive geographic distribution, occupying aquatic habitats from the arctic tundra to the deserts of northern Mexico (Naiman et al 1988:753), with populations estimated at 60-400 million (Seton 1953).

This wide-ranging distribution suggests an ability on the part of the beaver populations to adjust successfully to a wide range of ecological conditions, including zonal macroclimatic variability. Kendeigh (1961:124) cautions, however, that it is not sufficient to consider only the macroclimate in the study of animal behaviour, as faunal forms also respond to the microclimatic conditions of their particular habitats. This generalization is particularly true of beaver, when one considers their highly sedentary nature and restricted foraging radius. As previously noted, there is a general consensus of opinion that most trees are utilized within the first 30 m (100 ft) from the water, with estimates for maximum foraging radius ranged from 100 yards (91 m) to 500 ft (152 m). Hiner (1938:317-19) found that beaver were able to forage somewhat greater distances, up to 450 ft. (137 m), on fairly steep slopes. In a similar vein, in Colorado Rutherford (1964) found that "the area suitable for beaver food production is limited to watered valleys and immediately adjacent slopes and seldom exceeds 2.5 percent of the total watershed area"(1964:17).

The above spatial habitat restrictions no doubt contributed strongly to the observed opportunistic or flexible nature of beaver behaviour, particularly in regards to food requirements. Bradt (1938:153) notes that a summary of the kinds of species used by beaver would include nearly every plant growing within its habitation range. Allen (1983:1) similarly refers to the beaver as a generalized herbivore, noting that the leaves, twigs, and bark of woody plants are eaten, as well as many species of aquatic and terrestrial herbaceous vegetation.

Another contributing factor towards the use of a broad spectrum of resources is related to the nature of beaver habitats, which Todd (1978:33-34) basically defines as two types: stream and lake/potholes. Since the study is mainly focused on the Plains region, the stream/river systems are the main beaver aquatic environment, which in turn is an integral part of the Valley Complex. As previously noted, the distinguishing characteristic of this vegetative community is pronounced microclimatic variability determined primarily by factors other then zonal climate. Factors such as aspects of slope, depth of valley, etc., create habitat variability not only in the vertical plane (i.e., from the uplands to the stream edge) but along the horizontal plane, expressed most visibly in the contrasts between northern and southern exposure slopes. Thus, along any specific tributary a wide range of habitats can be found with marked differences occurring not only in species composition, but in species abundance. Correspondingly, at any point in time resource utilization by beaver along a particular waterway may exhibit appreciable variability. In research along the Rio Grande River in Texas, Strong (1982:69) pointed out that the five beaver colonies monitored varied greatly in habitat structure, and consequently use of food resources varied among colonies.

The above resource variability also occurs within a relatively limited space so that individual species populations are generally low. Combining this factor with the beaver's limited foraging range, we also find a temporal dimension in resource utilization; as one food species becomes depleted another becomes more intensely utilized. For example, aspen is often referred to as a subclimax community because prolonged beaver use generally leads to depletion; and, if present, willow and sedges become the mainstay in the beaver diet (Rutherford 1964:28). Also the depletion by beaver of one species may stimulate the development of another, also altering the resource base. According to Naiman et al (1988:756), as aspen is depleted in the riparian zone, and the area becomes more open, shrubs such as alder and hazel become the dominant forms.

Naiman et al (1988:757) have particularly stressed the importance of beaver activities as a contributing factor to the complexity of the stream ecosystem structuring. They note that, "A beaver-impounded landscape is thus a mosaic of different vegetation types - due to the dynamic hydrology of beaver ponds, the diversity of preimpoundment vegetation, and the changes caused by beaver foraging in the riparian zone" (1988:757). Therefore beaver habitat requirements are related, through time and space, to a highly variable and changing (often beaver-induced) resource base, both on a macroclimatic and microclimatic level. The opportunistic and/or flexible nature of beaver behaviour is thus best able to cope with and/or adjust to these varying complexities.

Several authors (Slough and Sadleir 1977; Todd 1978; Allen 1983) have attempted to establish beaver habitat suitability models. Admittedly it would be difficult to accommodate microclimatic variability in a broad habitat model; however, regional or macroclimatic differences and their effect on beaver habitat requirements were often not recognized or adjusted for. These authors also have drawn their information from studies of beaver populations in more mesic or northern Woodlands areas. Many of their assessments, particularly of what constitutes limiting factors, have little applicability to more arid areas. For example, Slough and Sadleir (1977:1327), whose research was carried out in northern British Columbia, did not include water depth as one of the parameters in their land capability system for beaver, claiming that this factor was rarely limiting. In more arid areas such as Colorado (Rutherford 1964) and Wyoming (Collins 1979), insufficient surface water was emphasized as being one of the most important limiting factors, especially by fall.

Another example relates to beaver food resources. Authors such as Stegeman (1954:348), whose research was carried out in Huntington Forest, New York, and Hodgdon and Hunt (1955:411), whose research area was in Maine, not only stressed the preferential use of aspen by beaver, but also claimed that the distribution of beaver is largely determined by the distribution of aspen. However, in more arid areas, tree species are less abundant; and exhibit a different spatial distribution. In North Dakota, Hammond (1943:317) found that aspen although present was rarely accessible to beaver, being several hundred meters away from the river. Jenkins (1980b:566), aware of the above kinds of problems, cautioned that studies of aspen and willow in northern areas, in which they tend to be the predominant beaver foods available in riparian habitats, should not be generalized too quickly to other regions in which riparian vegetation may be more diverse. Referring to the beaver's opportunistic use of food and the diversity of its habitat, Jenkins (1980b:566-572) also criticized attempts by investigators to construct a list of preferred beaver foods by rank.

The same problem arises again in the determination of the effects of beaver activities on the environment. Most studies have not been of sufficient geographic extent to necessitate incorporating macroclimatic variability in their analyses. Therefore, coming from a narrower frame of reference, authors have put forth highly different perspectives on this aspect of beaver ecology. From their research in more northern regions, i.e., Quebec, Minnesota, and northern Alaska, Naiman et al (1988:753) broadly documented the environmental alterations caused by beaver, noting that their activities reduced erosion, created wet lands (by flooding), modified the riparian zone, and affected the composition and diversity of the plant and animal communities. They have, however, omitted one of the most significant environmental modifications attributed to beaver, particularly in more arid areas: the impounding of water and its effect on surface water conservation and maintenance. The above omission by Naiman et al, however, is understandable given that their research was conducted in more northern mesic environments. As previously noted, research in these areas strongly indicates that water resources are more than abundant.

The beaver habitat models noted here provided an initial framework for my own studies of beaver ecology. The broad focus on which the primary hypothesis is based requires a comparative analysis of woodland and plains regions, and the effects that these environments have on beaver populations. However, to relate these ecological conditions to human needs, particularly the determination of human settlement patterns, requires the focus to shift and narrow to the microclimatic level of analysis. It was found that with the exception of some trade in lithic materials, the peoples associated with the bison hunting tradition, prior to contact, were dependent on their immediate environment for essential resources. To perceive ecological conditions from this narrower scope, field research was carried out in specific areas representing both Woodlands and Plains.

RESEARCH OBJECTIVES

Within the chosen research areas the study of beaver ecology will involve two perspectives:

Part A: The determination of beaver habitat requirements, and how environmental conditions in the various particular study areas accommodate these requirements. Of equal importance is defining which specific components act as restraints on beaver population size and density. On the Plains the availability of adequate surface water supplies, assumed to be the main limiting factor, will be given special consideration. Analysis of food requirements will centre on the use of tree/shrub forms, which on the Plains are also perceived as being of limited availability. More specifically, the focus will be on whether beaver habitat requirements affect the abundance of tree/shrub species.

In the Woodlands research area the focus is different, since surface water resources and treed areas are not limited. Open areas, however, are restricted; and provide the main source of herbaceous foods (grass/sedges) and many shrub species which are considered important components of the beaver's diet. It is this aspect, and the beaver's response to these limitations, that will be examined.

Part B: The determination of the effects of beaver activities on the environment. The study will focus exclusively on examining the effects of beaver activities on the availability of surface water resources. The nature and extent of beaver conservation of water resources will be tested from two perspectives:

(i) The effectiveness of beaver dam/pond systems in maintaining water resources. This study entails the measurement of water levels from spring run-off to freeze-up. Several factors are considered in the analysis: amount of spring run-off, precipitation, temperature, and evaporation rates.

(ii) The determination of the structural mechanisms operative in beaver water control. This analysis includes a study of dam porosity, dam size, pond depth, and the ratio of dams/lodges/unit area. Given the above, the study will then carry out a comparison of the different order tributaries to determine what effect their specific habitat attributes have on beaver settlement patterns.

For the Woodlands area the study examines several aspects of beaver activities and their corresponding short and long-term effects on the environment. Perhaps the most important is the effect of flooding, with the consequences of the destruction of important browse and graze species. The effects of beaver cutting, and the resulting changes in abundance and distribution of vegetative species, are also examined.

ANALYSES OF RESEARCH AREAS: THE PLAINS

Study Sites and Methods

Research in the Qu'Appelle River Valley was initiated in early June of 1986, but at this time was restricted to Cottonwood Creek. The area from the confluence with Wascana Creek to the C.P.R. dam near the town of Rufus (38.5 river km) was surveyed, with the emphasis strongly centred on locating archaeological sites. Ecological analyses concentrated on establishing the extent of beaver occupation in the tributary. Measurements of water levels were begun in two areas: the Campbell I site (Fig. 5), and the Young site; they were discontinued at the end of August.

In 1987 field research was also restricted to Cottonwood Creek. Water level

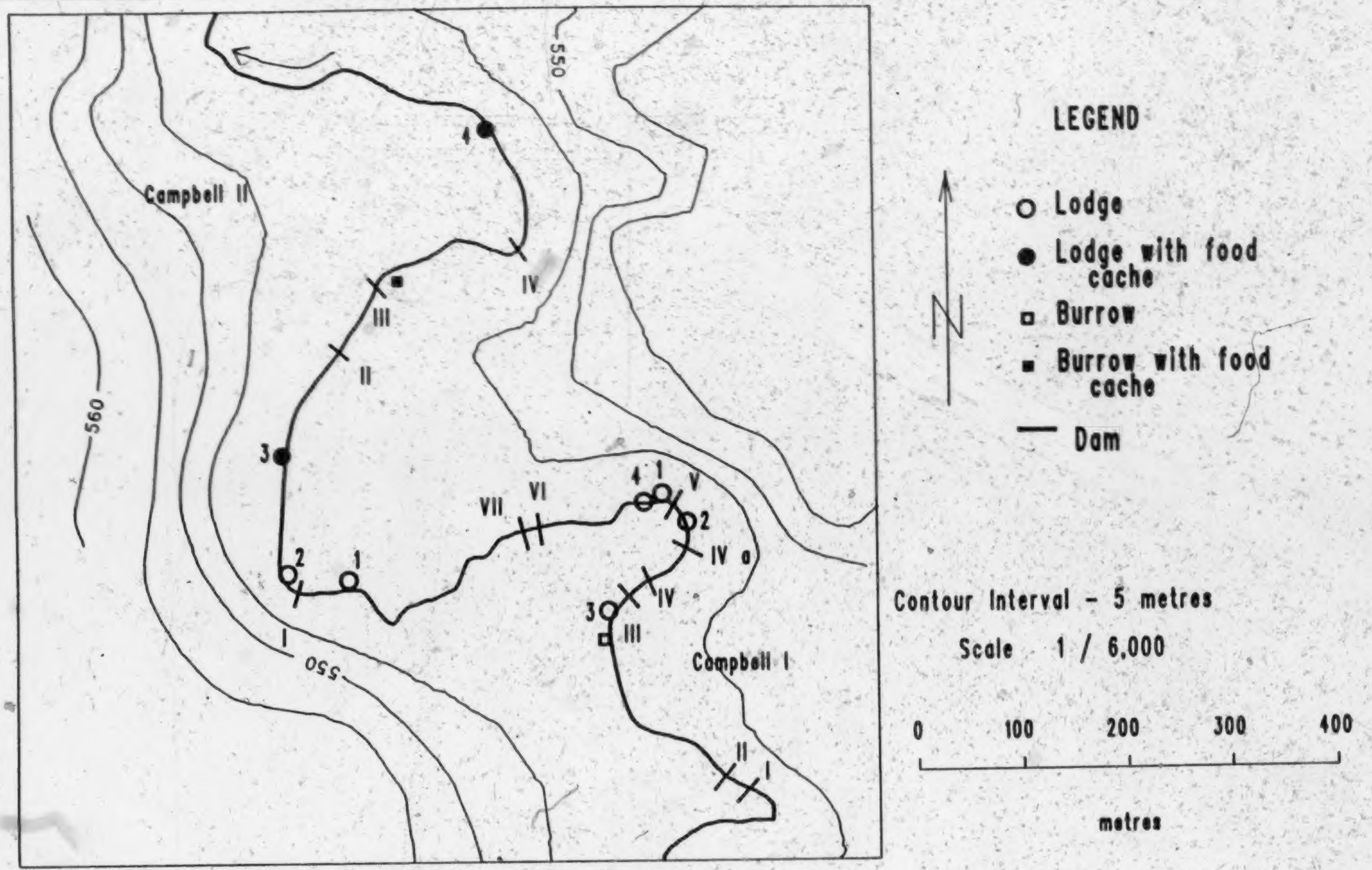
550
550
560
Campbell II
Campbell I
4
IV
III
II
3
2
1
I
VII
VI
4
1
V
2
IV a
IV
3
III
II
I
LEGEND
○ Lodge
● Lodge with food cache
□ Burrow
■ Burrow with food cache
— Dam
N
Contour Interval - 5 metres
Scale 1 / 6,000
0
100
200
300
400
metres

Figure 5: Campbell I and II Research Areas (Cottonwood Creek)

measurements were again taken at the Campbell I site and at the Young site, and discontinued at the end of August.

In 1988 the research area was markedly expanded to allow for a comparative analysis, both archaeological and ecological, between different size waterways. The waterways selected were as follows: (a) Qu'Appelle River (the main waterway); (b) Wascana Creek and Moose Jaw River (large-size tributaries); and (c) Cottonwood Creek (a medium-size tributary) (Fig 2). Pronounced microclimatic variability also prompted the establishment of two additional research areas on Cottonwood Creek - Campbell II and Thompson III. Each area exhibited its own unique combination of physical and vegetative attributes, and also variations in surface water availability. Given the above, it was hoped that the study would be able to distinguish the extent of commonality in beaver behaviour, as well as the opportunistic responses elicited by the above habitat variations.

In 1988 water measurements were discontinued at the Young site, as most of the beaver ponds had become dry. Water measurements at Campbell I were begun on May 29, at Campbell II on June 5, at Thompson III (Fig. 6) on July 13, and on the Moose Jaw River (Fig. 7) on August 17. All measurements were discontinued on October 30.

Attempts were also made in 1988 to quantify the differences in availability of surface water resources on the different size waterways. Water depth and stream width measurements were taken every 10 meters on the different order tributaries between August 15 and August 20. On Cottonwood Creek three research areas were measured: Campbell I, which extended for 0.60 river km; Campbell II, which was 0.75 river km; and Thompson III, which was 0.41 km. Measurements from Campbell I and II were combined, totalling 1.35 river km, in the comparative analysis with the Moose Jaw River where 1.54 river kilometers were measured. In the statistical analyses, water depths at lodges were generally the mean of the two nearest measurements, to accommodate food caches which were often 20 m in extent. Some attempts (though not extensive) at quantification of beaver foraging and construction strategies were made at the Campbell I

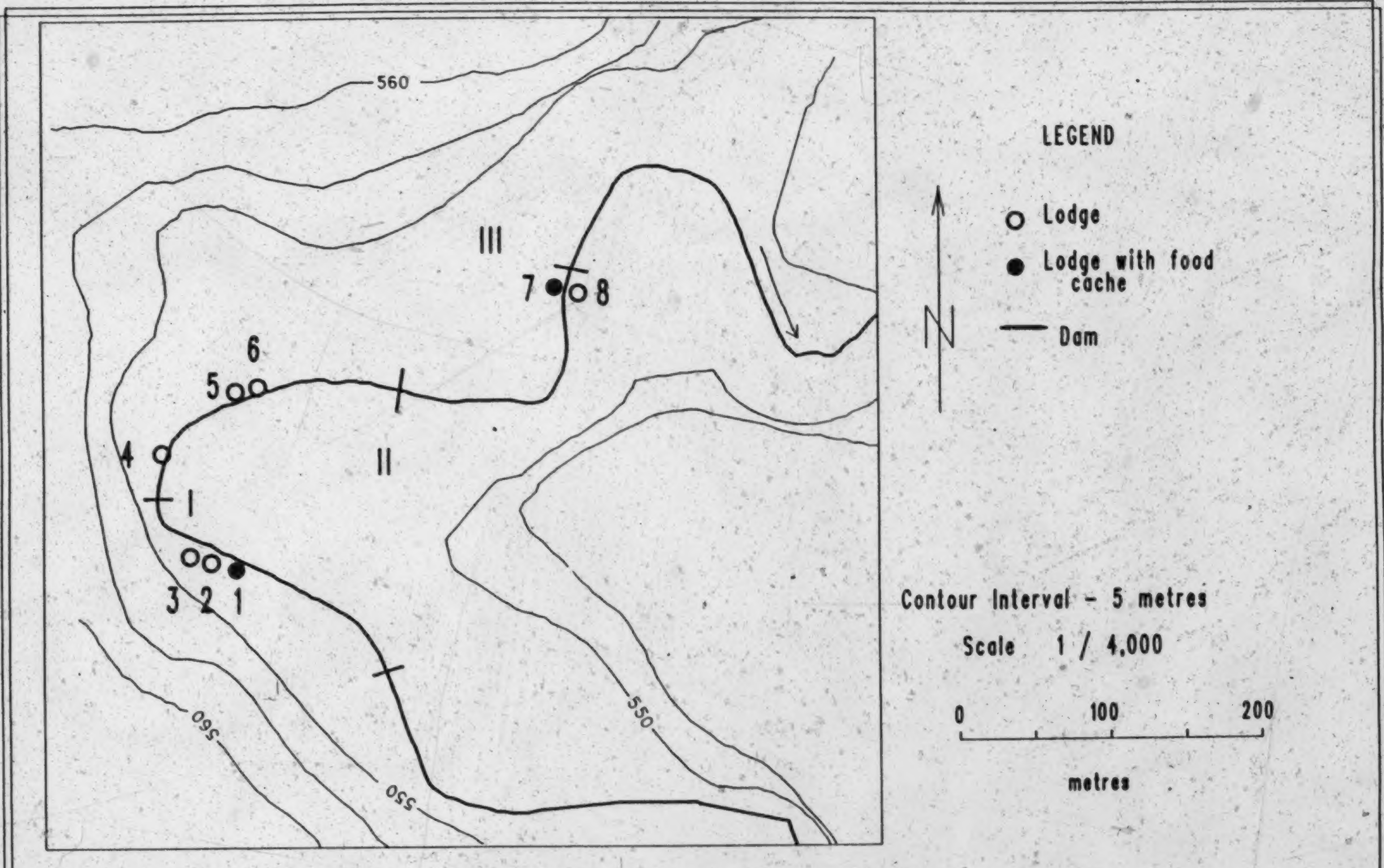
560
550
550
560
III
II
I
1
2
3
4
5
6
7
8
LEGEND
○ Lodge
● Lodge with food cache
— Dam
N
Contour Interval - 5 metres
Scale 1 / 4,000
0
100
200
metres

Figure 6: Thompson III Research Area (Cottonwood Creek)

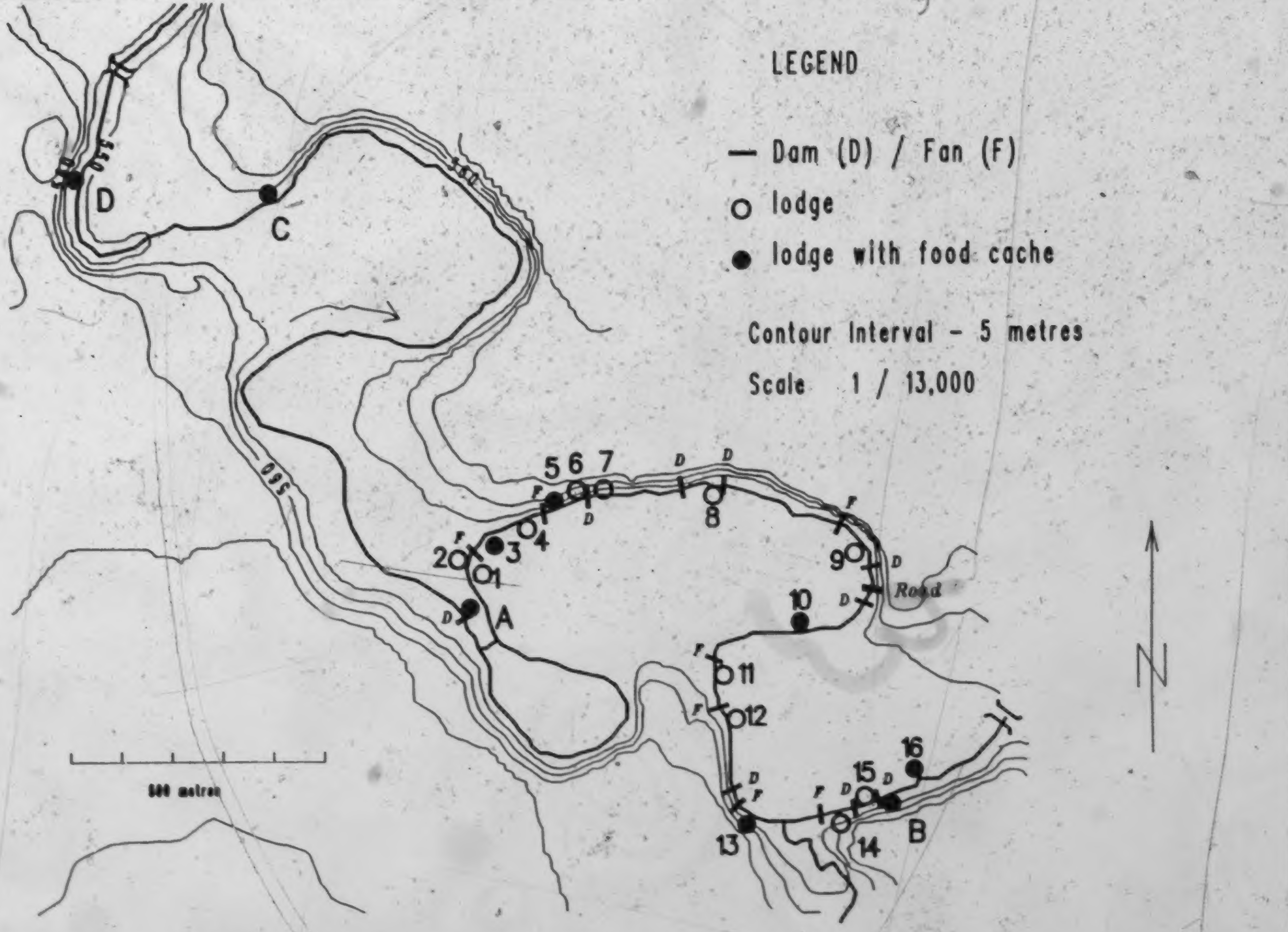
LEGEND
— Dam (D) / Fan (F)
○ lodge
● lodge with food cache
Contour Interval - 5 metres
Scale 1 / 13,000
500 metres
Road
560
550
A
B
C
D
1
2
3
4
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Figure 7: Moose Jaw River Research Area

site. Since the focus wason determining the effects of beaver activities on treed areas, which are considered a limiting factor, studies were restricted to the most abundant tree-size species, i.e., chokecherry and maple.

For the chokecherry population, a random sample was taken from a 5 m by 30 m plot extending perpendicular from the water's edge. Since all maples were felled (by beaver) within the first 15 m and 10 m from the stream edge, at the Campbell I and Campbell II sites respectively, the measurements were restricted to only a cut sample. At the Campbell I site a random sample of 60 diameter measurements was taken from one lodge and one dam, and compared to the cut species populations. The Moose Jaw River studies, carried out in the summer of 1988, focused on surface water resources in terms of availability and stability. Vegetative analyses were cursory, and no attempts at quantification were attempted. No field research was carried out on the Qu'Appelle River - the main waterway.

Initially Wascana Creek had been chosen for both ecological and archaeological analyses. However, problems arose almost immediately as to its suitability as an ecological research area. Consultations with the Water Resources Branch, Environment Canada, found that Wascana Creek is subject to marked discharge fluctuations that bear no relation to natural climatic perturbations. The primary source of these fluctuations is the city of Regina; its treated sewage as well as the waters collected by its storm sewers flow into Wascana Creek. L. Heinz, from Environment Canada, recommended that the Moose Jaw River above Thunder Creek would be more suitable, since its flow charts show a closer approximation to natural conditions; and also it is comparable to Wascana Creek in drainage area. It was decided to continue the archaeological survey of Wascana Creek, but the ecological research was moved to the Moose Jaw River.

There also were local perturbations on the Moose Jaw River that affected the precision of the analyses, although it is maintained that the general trends remain predictive and accurate. One major disturbance was agriculture. Fields were often cultivated too close to the waterway, resulting in the destabilization and increased erosion of stream banks. Thus, tree/shrub areas were also greatly reduced, diminishing the availability of food resources and building materials for beaver populations. Overgrazing, of both browse and grasslands, by cattle in another portion of the research area no doubt contributed to the lack of beaver in the vicinity. Another problem was the complete eradication of beaver from one area by the resident farmer. The reason given was that beaver destroyed farmyard trees. This problem was also encountered on Cottonwood Creek. It was found that human residence patterns strongly influenced the nature of responses to the presence of beaver in an area. Families choosing to live on the floodplains, in close proximity to beaver, tended to perceive them as a nuisance. Problems associated with beaver included the destruction of ornamental trees, and the flooding of basements by raised water tables. Generally, the presence of beaver was considered advantageous, particularly as a means of maintaining surface water resources for cattle and garden plots. Research conditions were more ideal in Cottonwood Creek, as agriculture is not extensive; in fact, some areas still retain natural prairie. Many areas have been also allowed to revert back to grasslands, and are used primarily as pastures. The waterway has generally experienced fewer disruptions, with many of the original stream beds still retaining their viability. As a result, most of the ecological studies were carried out on Cottonwood Creek.

The Qu'Appelle River is also a poor prospect for ecological analyses. The water levels are artificially maintained by a man-made channel joining Buffalo Pound Lake with Lake Diefenbaker. Water is diverted from Lake Diefenbaker to the Qu'Appelle Valley Dam (Canada-Sask-Man. Govts. 1972:7). It is therefore indeterminate as to what extent information on contemporary beaver activities would be representative of a "natural state".

Detailed descriptions of the different size waterways (Cottonwood Creek, Moose Jaw River, and Qu'Appelle River) can be found in Appendix I.

Comparison of Different Size Waterways

Given the marked annual variations in discharge volume, days of flow, and the initiation and termination of flow exhibited by all the different order waterways, only broad generalities can be deduced. Spring runoff, originating primarily from snowmelt, is the major source of surface water supplies, since moisture from summer precipitation is normally used up by evaporation. As a result maximum discharge occurs during spring runoff, with reduced flow or no flow during the rest of the year, establishing a general pattern of high water levels in spring progressively dropping to low levels in fall.

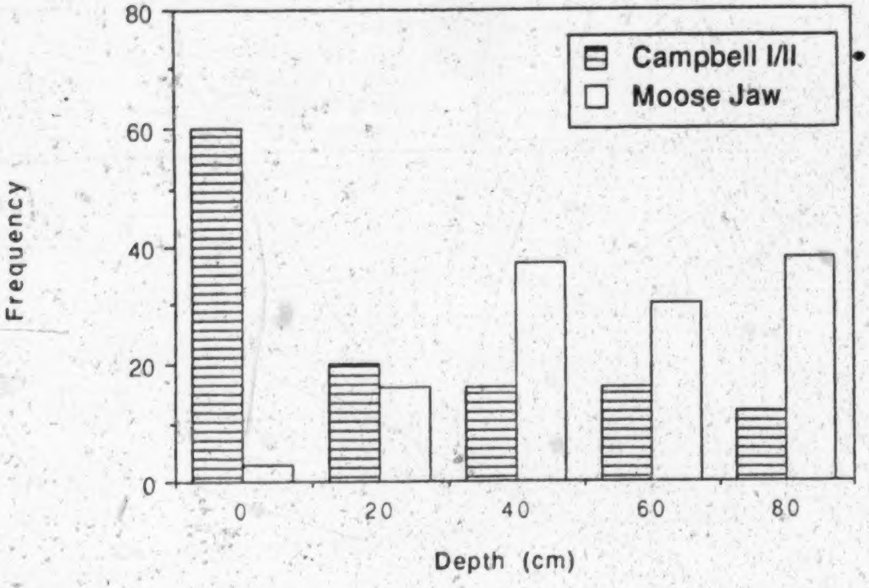
Between the different order tributaries there are substantial variations in surface water availability and stability. The Qu'Appelle River is generally excluded from these analyses, as its water levels were artificially maintained. The overall mean annual discharge flow at Moose Jaw River (2.64 cms) is significantly greater [DF = 54; t = 5.098; P = < 0.000] than at Cottonwood Creek, which registered a mean discharge flow of only 0.452 cms or 17% of the Moose Jaw mean. During the drought (1986-88) the mean annual discharge flow at Moose Jaw River dropped to 0.500 cms, while at Cottonwood Creek the mean discharge dropped to 0.041, becoming only 8% of the Moose Jaw mean. Therefore, during drought, the amount of discharge flow was reduced to a greater extent at Cottonwood Creek. It should be noted that at the height of the drought (1988), discharge flow at Moose Jaw River had almost ceased (0.001 cms), while at Cottonwood Creek no flow occurred.

The above difference points out another important attribute of the Moose Jaw River (a large tributary); i.e., a greater ability to withstand macroclimatic perturbations. Although initiation and termination of flow at both tributaries can exhibit marked variability, the general trend is for discharge flow to begin in March, with maximum discharge occurring sometime in April. The significant difference is that on Cottonwood Creek flow tends to end by July, while on the Moose Jaw River flow continued well into October. This difference is reflected in the number of days of flow per annum: on

Cottonwood Creek the mean is 81.6 days; while on the Moose Jaw river the mean is 190.8 days. The above indicates that under most climatic variations, Cottonwood Creek is an intermittent stream, while Moose Jaw River has flow during most of the vegetative season. The greater resistance of the Moose Jaw River to macroclimatic fluctuations is again exhibited in the relationships between the amount of annual discharge flow and days of flow. On the Moose Jaw River the correlation was weak (r^2=.24), while on Cottonwood Creek the correlation between the amount of annual discharge flow and days of flow was much higher (r^2=.63).

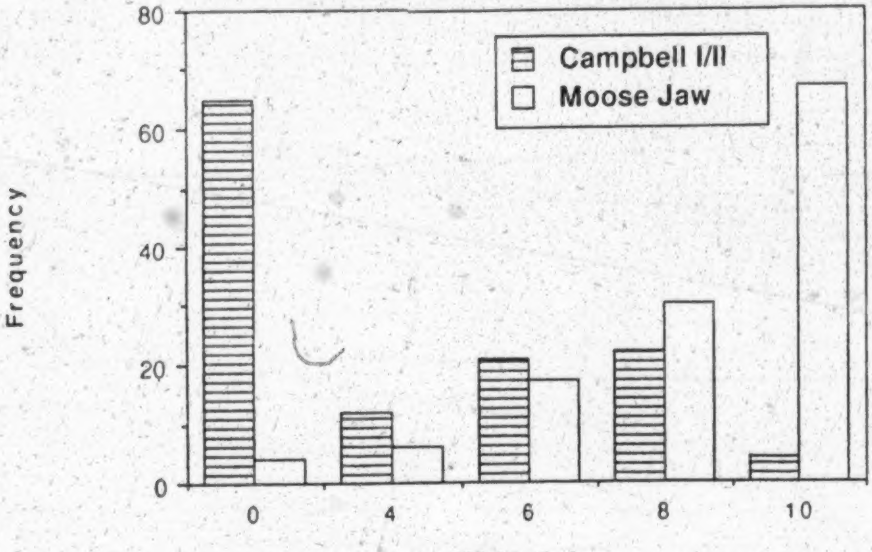
Measurements were carried out at both tributaries to establish a more precise determination of the availability and/or quantity of surface water resources. The measurements from the combined Campbell I and II areas extended for 1.35 river km, while the Moose Jaw River area included 1.54 river km. The Chi-square test indicated a significant difference in the frequency distribution of water depths between Cottonwood Creek and the Moose Jaw River (Fig. 8). Similarly, there was a significant difference in the frequency distribution of stream widths between the two tributaries (Fig. 9). Given the above, the quantity of surface water in the Moose Jaw River, calculated on the basis of stream width and water depth, was significantly greater than in Cottonwood Creek. It should be noted that the above generalities give a more accurate picture of the large tributary because there water resources are more uniform. On a small tributary water resources are uneven, resulting in marked local variations, both in distribution and quantity. More specifically, statistical tests indicate that on Cottonwood Creek there were significant differences in surface water abundance between the three beaver-occupied research areas (Figs. 19, 20; Appendix I).

The nature of the vegetation of the different order tributaries can be generalized more readily, as local factors of a constant nature (e.g., aspect of slope) are more important than zonal climate in determining the vegetative character of the Valley Complex. Tree/shrub species are not abundant in the different size tributaries, but they reach their



DF=4; Chi^2=151.096; P=<0.00

Figure 8 Comparison of Water Depths Between a Large and Small Tributary



DF=4; Chi^2=1056.167; P=<0.00

Figure 9 Comparison of Stream Widths Between a Large and Small Tributary

highest densities on northern exposure slopes. Herbaceous species, i.e., grasslands, are the dominant vegetative forms occupying southern exposure slopes and the floodplain. The same species occur on all different order waterways, with some similarities in abundance and distribution. Aspen is located most often on middle and lower portions of northern exposure slopes, on the floodplains adjacent to the slope edge, and in coulees. In terms of distribution, maple is the most common tree species, being found on northern exposure slopes, in ravines, and on the floodplains. Being also a riparian species, it is frequently located along the edge of the waterway. Ash is found in the valleys, most frequently on northern exposure slopes, and also near the water's edge. Although present, elm is scarce. The most abundant and ubiquitous tree/shrub species is chokecherry. Saskatoon, hawthorn, and rose tend to be most abundant along northern exposure slopes; and may fringe the waterway. The most important and generally ubiquitous riparian species are willow and dogwood.

There are, however, important variations between different size waterways in regards to the distribution and abundance of tree/shrub species, the differences relating mainly to the availability of surface water resources. On a smaller tributary surface water by fall is restricted mainly to select areas, where a waterway tends to cut a slope wall (Plate 1). Therefore tree species tend to be mainly found on northern exposure slopes and ravines; and may fringe the waterway when it approaches these areas. When the waterway is more centrally located surface water tends to evaporate by fall, and riparian species are restricted to shrubs or absent (Plate 2). Along a larger waterway water resources are more abundant and continuous during most of the vegetative season, providing a broader range of suitable habitats for tree/shrub species. Species such as maple and ash are not restricted to northern exposure slopes, and are able to flourish along the banks of the waterway under more open conditions. Ash is particularly more abundant on the large tributary, replacing chokecherry, to some degree, in the various habitats. Riparian species such as dogwood also appear to be less common in large waterways, perhaps being more suited to the more open canopy conditions of smaller tributaries. Aspen is also more abundant in the larger tributaries, in which deeper valleys and coulees provide more suitable habitats.

These differences between different size tributaries strongly influence beaver habitat distribution patterns. On Cottonwood Creek suitable beaver habitat is primarily restricted to a specific spatial configuration, i.e., when the waterway is in proximity to a treed northern exposure slope; and when water resources are of sufficient quantity that the beaver, through their dam/pond systems, can effectively maintain the depth and extent necessary for dwellings and access to food caches in winter. The above habitat configuration has a combination of attributes that are highly advantageous for beaver occupation. Given the beaver's narrow foraging range, the proximity of the waterway to treed slopes would greatly enhance resource availability. Because erosional activities are greatest where the waterway approaches the slope wall, the stream is more deeply incised in this area. Higher banks, which are more suitable for lodges and dam construction, and perhaps most crucial, a deeper waterway (greater volume of water), provide an initial combination of attributes that can be more easily manipulated or controlled by beaver.

The structural aspects of this habitat configuration also increase and optimize spring runoff. Treed northern slopes increase snow capture, and shading by both trees and slopes reduce the effects of evaporation. It was found that beaver dam/pond units directly associated with treed slopes capture significantly larger amounts of spring runoff than other areas of the dam/pond system. If the slope also has breaks, such as gullies and/or coulees, these physical features are even more effective in snow capture. In addition these breaks act as catch basins for precipitation, which is fed directly into the associated pond during the vegetative season. Therefore, the pond not only registers higher water levels during spring runoff, but water loss is retarded during the summer.

On Moose Jaw River suitable beaver habitats are not as restricted, because the waterway is more deeply incised, and water resources are generally continuous.

Tree/shrub species are thus more abundant and continuous along the waterway. The above ecological conditions provide a broader variety of suitable beaver habitats, resulting in a more ubiquitous distribution of beaver populations. However, there is still a strong tendency for beaver populations to cluster in areas in which the waterway cuts a northern exposure slope. Floodplains on a large tributary, as compared to a smaller tributary, are much broader; and on the Moose Jaw River may reach up to 0.5 km in extent. When the waterway is more centrally located, tree species such as aspen, which tend to fringe the valley slopes, are generally inaccessible. Proximity of the waterway to treed northern slopes provides a greater abundance of resources. On the main waterway, as compared to the tributaries, water resources are the most abundant. The factor acting against beaver occupancy is the broad floodplains, ranging from 1 mi (2 km) to 2 mi (3 km) in extent. Although the waterway is highly sinuous, it rarely approaches the slope wall to within the beaver's foraging range; many tree/shrub species are thus inaccessible (Fig. 15). Food sources tend mainly to be limited to riparian species.

The differences in surface water availability between different size tributaries strongly influence beaver behaviour and bring into focus the important role that beaver play in the conservation and maintenance of these resources. As previously noted, on a small/medium-sized tributary surface water is limited and unevenly distributed. Therefore, when beaver first occupy a suitable area, it is crucial that their activities be directed towards the capture and maintenance of this resource. Primary dams function in this capacity, providing complete closure of the waterway so that sufficient depth and volume can be generated for beaver manipulation (Plate 3). The structural nature of dams, particularly primary dams, greatly facilitates surface water conservation. The dams are triangular in cross-section. As water levels drop the width of the associated dam surface increases, permeability decreases, and consequently the outward flow from the pond decreases. In primary dams/pond units, which are the deepest, this process continues to the point where the dam becomes impermeable - often the case during drought.

As spring runoff subsides, beaver dams begin to emerge. As early as late April beaver begin to regulate water resources so that sufficient amounts remain, by the end of the vegetative season, for overwintering. Intricate systems of secondary dam/pond units are built to aid in this maintenance process (Plate 4). When located upstream, they regulate and prolong flow of water into the primary units. If located downstream, they back up water resources against primary dam/pond units reducing flow. Primary dam/pond units also contain the lodge (Plate 5). Therefore during dam construction, bank sediments are incorporated into the dam; and also bottom sediments which are removed as beaver deepen the pond to the required depth essential for overwintering. In other words, a simultaneous deepening and widening of the pond occurs. Statistical tests on the small tributary showed that water depths in proximity to the lodges were significantly deeper than those for the overall waterway (Fig. 18, Appendix I) Deeper ponds are more resistant to evaporation.

It was also observed that treed areas could substantially increase spring runoff in the associated beaver pond, whereas slopes containing coulees or gullies could not only increase spring runoff but, by concentrating precipitation into these associated ponds, reduce water loss during the vegetative season. Interestingly, the ponds associated with the above slopes generally contained the active lodge. In support of the above analyses it was found that all primary dam/pond units containing an active lodge were the most stable; i.e., exhibiting the least drop in water levels during the vegetative season (Tables 1-5, Appendix I).

On the large tributary greater annual discharge flow, continuing through most of the vegetative season, also affected beaver behavior. Containment of surface water resources did not usually begin till late in the season when discharge flow had subsided, with a corresponding drop in water levels. It is probably not structurally possible for dams to act as containment units earlier in the season because stream flow is too strong. When dams first emerge they are generally flat and fanlike, because strong stream flow has eroded the top of the dams, and deposited sediments along the closed end (Plate 6). There is usually a channel (1 to 2 m in width), cutting through the dam along one side of the waterway, allowing for free movement of water and beaver populations. As late as August the dam/pond systems were still generally open. Complete closure of waterway, and the resulting containment and regulation of surface water resources, did not occur till September, even at the height of the drought (Plate 7). Because surface water supplies are more abundant, there is no need for the intricate systems of primary and secondary dam/pond units found on a smaller tributary.

These differences in beaver alterations on the different size tributaries are reflected in the correlation coefficient between water depth and stream width. On Cottonwood Creek it is very strong (R^2=.770), reflecting the simultaneous widening and deepening of the waterway; while on Moose Jaw River the correlation is weak (R^2=.209).

There is one exception to the above: on a large tributary, because of greater erosional activities, beaver populations must work harder to maintain the depths needed for movement between lodge and food cache. Statistical tests on the Moose Jaw River did not indicate a significance difference between overall water depths and those associated with lodges. However, to obtain a large enough sample both abandoned and active lodges were included in the analyses. Water depths associated with abandoned lodges often were shallower then the overall mean. Abandoned food caches and lodge structures, acting as impediments, increased siltation in the vicinity of the abandoned lodges. On the smaller tributary, because the stream is controlled and regulated almost from spring runoff, erosional activities are markedly decreased. The water depths needed to insure movements between lodge and food cache area are one of the few precisely defined beaver habitat requirements that must be met regardless of the regional setting; Todd (1978) calculated this to be 3-5 ft (91 cm -152 cm). Active lodges (2) on Cottonwood Creek at the end of 1988 conformed to this range, having water depths of 96 cm and 122 cm. The one active lodge on the Moose Jaw River for which a depth measurement was available registered 94 cm. The low readings attest to the severity of the drought.

On Cottonwood Creek, even under average climatic conditions, water resources are unevenly distributed; many areas became dry by fall. By the end of the drought cycle most of the tributary, including many areas previously occupied by beaver, had become a dry stream bed. The remaining water resources were locked mainly into discrete beaver ponds (mostly abandoned) containing varying degrees of water. On the Moose Jaw River the pattern was somewhat reversed. There were long stretches of continuous water separated by short dry sections that often contained a few isolated pools, mostly beaver-influenced. Field research was not carried out on the Qu'Appelle River (the main waterway) because water levels are artificially controlled. Here beaver rely solely on bank dens; lodges are not built because of swift stream flow. It could be assumed that dam construction would also be severely hampered by swift stream flow. On the other hand, because of the greater abundance of surface water, dam/pond systems may not really be required. It also was assumed that the main waterway would be able to withstand the effects of drought more effectively. However, during prolonged drought, as stream flow is reduced and water levels drop, the resident beaver populations may be forced to construct dams to maintain sufficient surface water.

Field research during what is considered to be the severest drought cycle of the century (1986-88) gave the opportunity to study its effect on beaver movement patterns. On both tributaries, the initial factor causing lodge abandonment was fluctuations in water levels, i.e., a marked drop which exposed lodge entrances, necessitating movements, generally localized, to lower levels. On Cottonwood Creek, because surface water resources were more limited, several other factors came into play as the drought intensified. Some beaver dam/pond systems began to disintegrate into a series of small ponds. Some of these ponds, although exhibiting adequate depth, were abandoned because of insufficient extent to accommodate both lodge and food cache. However, insufficient water resources (more specifically, insufficient depth) was the major factor in more permanent movement of beaver from the tributary. By the fall of 1988 (at the height of the drought cycle), approximately 13 areas that had previously exhibited evidence of beaver occupation were abandoned. On the large tributary (during the same time) it was found that by fall, although two lodges were abandoned, two new ones were established in the vicinity. In other words, beaver movements were localized to areas in which surface water was more abundant.

This discussion brings up the question of what happens to the beaver colonies when they are forced to abandon an area for a prolonged period of time, or permanently. Previous studies of beaver populations on the Qu'Appelle River answer some of these questions. During a drought year, in late fall, active colonies increased in some areas by 48%. It is inferred that during drought, there is an inward movement of beaver populations from the small/medium-sized tributaries to the larger waterways, initiated by the diminishing availability of surface water resources. Some of these colonies may re-establish in some of the larger tributaries, while others may be forced to move to the main waterway. When the drought cycle ends there should be a gradual outward movement of these beaver colonies back to the smaller waterways. Given the above, beaver population densities would show the greatest fluctuations on the main waterway, increasing markedly in the fall. Nevertheless, because of limited food supplies, they would still not be high. A previous survey calculated an overall density of 0.61 lodges/river km, but also noted marked variations between more specific areas.

It has been suggested that large tributaries most frequently provide suitable beaver habitat; therefore, they should exhibit the highest colony densities. As previously noted, the overall average density of beaver populations on Pheasant Creek, a large tributary of the Qu'Appelle river, was 1.0 lodges/river km (Beaver Food Cache Survey, Oct. 22, 1979). An area including a part of the Moose Jaw River and a small section of the Qu'Appelle waterway had the highest beaver densities (1.61 colonies/river km) in the valley (Sherratt and Hatch 1977: 12). On Moose Jaw River during the height of the drought, beaver population density was 1.2 lodges/river km along 5.8 river km (including the research area). This density would be too high for the overall tributary, as a clustering of lodges occurred in an area affected by a spring, which contributed substantially to surface water availability. During the height of the drought beaver density on Cottonwood Creek was 0.13 lodges/river km.

Field research on beaver foraging strategies was mainly restricted to Cottonwood Creek; however, some broad comparisons between different size tributaries can be inferred. On the small tributary tree species are of limited abundance and restricted distribution. These limitations are reflected in the beaver foraging strategies. Riparian species such as willow and dogwood are most frequently found in food caches. Other shrub-like species such as chokecherry and saskatoon berry are also utilized. Aspen is not common along the tributary, but when present and accessible is used both as food and construction materials. In other words, availability is the major factor influencing resource selection. On large tributaries there is a shift to tree species, such as ash and maple, these being most frequently found in food caches. Again the greater abundance of these species is the determining factor in use. Chokecherry continues to be an important component of food caches, reflecting its ubiquitous distribution in the Qu'Appelle Valley. On large tributaries aspen is more abundant; but the floodplains are broader, resulting in this tree species continuing to be mostly inaccessible. On the main waterway riparian species, mostly willow, are the major components of beaver food caches. This restriction is due to the central positioning of the waterway on the broad floodplain, bringing it only rarely in proximity to the valley slopes. Again availability is the main factor influencing selection. Herbaceous materials no doubt played an important part in the beaver's diet in earlier times. It was observed that in late fall the use of woody materials increased substantially, not only in terms of food cache construction, but for immediate use. The curing of grassland species may be a contributing factor to the above increased usage.

On the small tributary, chokecherry was the major component in dams and lodges (Fig. 17, Appendix I). Small amounts of maple were also incorporated. The above reflects the abundance and accessibility of chokecherry. There was also a definite selection pattern in the cutting of chokecherry, with beaver choosing to cut larger diameter (2-4 cm) chokecherry trunks in greater proportion than was available (Fig. 16, Appendix I). This selection pattern was also observed for dogwood and willow. The preference for large diameter specimens is ecologically advantageous. The removal of larger diameter size specimens accelerates growth in the smaller sizes. These dynamics make the species more resistant to heavy utilization by beaver. On the large tributary ash was an important component in lodges and dams, also reflecting its abundance. On the main waterway, lodges and dams were not usually built.

The availability of dry wood and logs in the Qu'Appelle Valley can be attributed primarily to beaver activities. When large trees such as maples, ranging from 12.0 to 34.8 cm in diameter, were felled, beaver debarked only the lower portions of the trunk, and infrequently removed the branches. Branches removed from maples ranged from 1.5 to 15.7 cm in diameter. Some of these branches were incorporated into dams and lodges, while others were strewn around the sites. Several of the larger branches were sectioned by beaver into more manageable portions and abandoned. On aspen trunks, ranging from 8 to 16.2 cm in diameter, almost all the branches were removed (Plate 8). Large trees such as ash, elm, and maple were often deeply chewed and debarked without being felled. These trees eventually died becoming standing dry wood. Dams and lodges are constructed from wooden materials (mostly chokecherry) ranging in diameter from 1.0 to 8.7 cm. Fluctuations in water levels, particularly low waters in fall, often leave the lodges above the water line (Plate 9), and also expose a good portion of the dams (Plate 4) so that the wooden components are dry. In addition, flooding in spring often removes appreciable amounts of materials from dams and lodges, which make up the driftwood found on the stream banks.

On the different order tributaries there is little evidence to suggest that beaver requirements for food and construction materials significantly affected the distribution pattern or abundance of the associated tree/shrub species. The preference for open canopy led to the removal of large trees near the waterway and in the vicinity of the lodge. On a small tributary this behaviour stimulated the succession to grasslands, and shrubby species such as chokecherry and saskatoon. On the large tributary the removal of trees resulted in the succession being more to shrubby species.

Consideration must also be given to the indirect effects of beaver conservation of surface water (e.g., raised water tables) on the associated vegetation communities. As previously noted these beaver alterations would be important factors in stimulating productivity in the associated plant species and delaying the curing process.

In summary, on a small tributary surface water, even under average climatic conditions, is intermittent, with flow ending by July. More specifically, by fall only select areas, primarily beaver-influenced, contain appreciable amounts of surface water on a year-round basis. These select areas are mostly associated with a particular spatial configuration, i.e., where the waterway is in proximity to a treed northern exposure slope, preferably with breaks such as gullies and/or coulees; and water resources are of sufficient quantity that beaver, through their dam/pond systems, can maintain the depth and extent essential for dwellings and access to food caches.

The restrictive nature of surface water requires that the beaver build elaborate dam/pond systems that become operative almost immediately with the initiation of spring runoff. Beaver also significantly deepen and widen the primary dam/pond units (containing the lodge) to satisfy habitat requirements. In spite of these efforts, during prolonged drought many of these dam/pond systems disintegrated because of the evaporation of surface water. Most beaver colonies were forced to vacate the waterway permanently. Those that were able to remain were generally confined to an isolated primary dam/pond unit. However, because of their structural durability, and the fact that erosional activities on a small tributary are not pronounced, many of these abandoned dam/pond units continued to capture and maintain surface water after the beaver had left.

A large tributary, then, carries a ~~greater~~ volume of water, which is generally continuous and flows during most of the vegetative season. Given these attributes it is also more stable; that is, more resistant to macroclimatic perturbations such as drought. Because surface water is more abundant and continuous, tree/shrub species, particularly tree species, are also more abundant; and have a broader distribution pattern. These ecological conditions provide a broader spectrum of suitable habitats for beaver populations, so that they reach their highest densities on large tributaries. The spatial configuration of the waterway in proximity to treed northern exposure slopes, however, still attracts beaver concentrations.

Because surface water resources are more abundant, beaver expend considerably less energy in the maintenance of these resources; control mechanisms, i.e., dams, do not generally become operative until late fall. During drought, reductions in surface water resources may lead to localized movements; however, major movements due to an insufficiency of surface water are rare.

In summary, on the main waterway surface water resources are the most favourable and stable. It is doubtful that beaver contributed significantly to water control or maintenance during average climatic conditions. First, surface water resources are probably adequate for wintering; and second, strong stream flow would have made dam construction not feasible, and probably not necessary. However, during prolonged drought, beaver populations may be forced to construct dams to maintain a sufficient amount of water. Also during prolonged drought, as water resources diminish, there would be a gradual movement of beaver populations from the small tributaries to the larger tributaries, and especially to the main waterway. Because of the central positioning of the main waterway on an extremely broad floodplain, most tree/shrub species associated with slopes are inaccessible. Inaccessibility to food resources thus places a limitation on beaver population size.

In conclusion, suitable habitats for beaver populations are most frequently found on the large tributaries. On the main waterway, inaccessibility to food resources limits beaver population size. On the small/medium sized tributary insufficient surface water is the crucial limiting factor.

ANALYSIS OF RESEARCH AREAS: THE WOODLANDS

Elk Island National Park (Fig. 10)

General Overview

The research area selected to represent a Woodlands environment is Elk Island National Park, which is located in central Alberta.The vegetation of the park is somewhat more complex than the term Woodlands denotes. Blyth and Hudson (1987:23-25) have defined Elk Island's parkland vegetation as in a transitional area between the prairie to the south and the boreal forest to the north; and suggest that the most suitable classification is "Parkland - Boreal Forest Transition Zone" (from Zoltai 1975).

The vegetation of Elk Island Park has been influenced by several factors. The broader region within which Elk Island is situated features flat to gently rolling topography, while the park is located in a hummocky area known as the Beaver Hills. This rough terrain, plus other conditions such as poor soils and restricted drainage, have allowed the development of small areas of boreal forest (Blyth and Hudson 1987:3). They also note that in earlier times frequent fires and large herbivore populations served to maintain the character of parkland vegetation. However, man-made changes, such as the elimination of fire and natural levels of herbivores, have altered the vegetation, "from open grasslands with small groves of aspen and spruce to today's aspen and spruce forests with grassland openings" (1987:3).

More specifically, the park is divided into two areas: the main area, located north of highway #16; and the wood bison area, which lies south of the highway. The main park

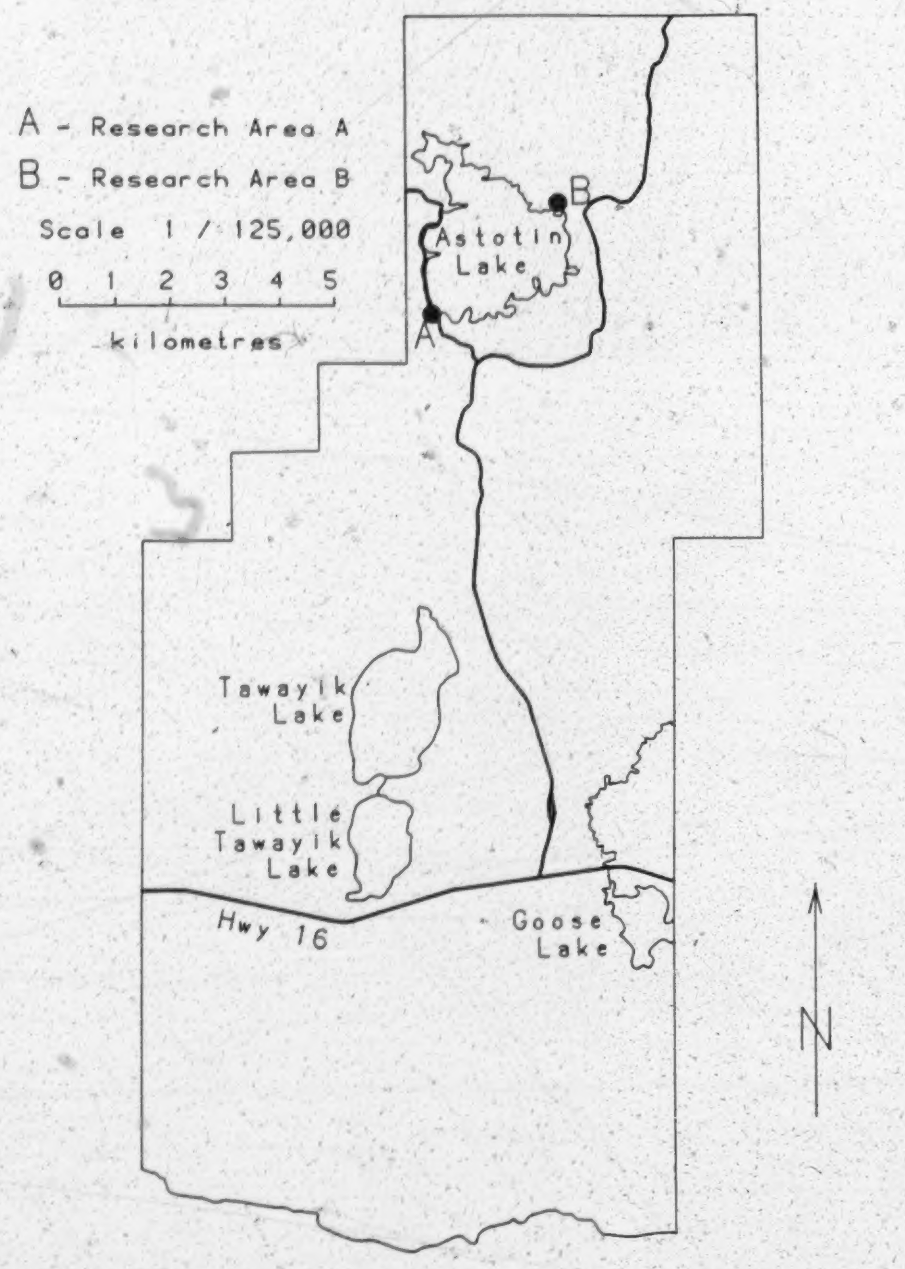

A - Research Area A
B - Research Area B
Scale 1 / 125,000
0 1 2 3 4 5
kilometres
A
B
Astotin Lake
Tawayik Lake
Little Tawayik Lake
Hwy 16
Goose Lake
N

Figure 10: Elk Island National Park Research Areas

area (136 km^2) consists of two sections: the north area, which surrounds Astotlin lake, and the south area, which is centered around Tawayik Lakes. Two research sites (A and B) were established in the north area (Fig 10).

The park vegetation consists of pure and mixed stands of aspen (*Populus tremuloides*), balsam poplar (*P. balsamifera*), and white spruce (*Picea glauca*). Tree species found on wetter or more poorly drained areas include black spruce (*Picea mariana*), tamarack (*Larix laricina*) white birch (*Betula papyrifera*), water birch (*B. occidentalis*), and speckled alder (*Alnus rugosa*) (Schwanke and Baker 1977:1). Shrubs and herbs include hazel (*Corylus cornuta*), prickly rose (*Rosa acicularis*), willow (*Salix spp.*), sedges (*Carex spp.*), and grasses (*Graminae*) (Blyth and Hudson 1987:25).

The broad regional climatic variations were discussed earlier in Chapter II. Specific climatic data is drawn from Blyth and Hudson (1987), who have used weather records from the city of Edmonton as their primary source of data. January is the coldest month, with a mean minimum temperature of -16.5°C. Mean temperatures of 0°C are experienced during spring (late March) and fall (late October). The mean maximum temperature occurs in July, and is +23.4°C (Blyth and Hudson 1987:10-12). The total annual precipitation is about 46.5 mm, with approximately 345 mm being rainfall, and the remaining 135 cm occurring as snowfall. Most of the rains occur between April and October; while snowfall occurs between September and May, with December, January, and February receiving the largest amounts (Blyth and Hudson 1987:13).

Elk Island Park is located in the North Saskatchewan River system, which drains into the Hudson's Bay. Surface water flow and storage are constrained within five local drainage basins. They all drain away from the park, because it is situated on a topographic high. The lakes in the park are shallow, and small fluctuations in surface water levels can cause flooding. Two of the larger lakes in the park are Astotlin and Tawayik. Spring snow melt is a significant source of surface water resources. Water levels generally decline during the summer, but do increase after a large rainfall. In fall, because of lower temperatures, reduced evaporation causes lake levels to rise prior to winter (Blyth and Hudson 1986:16-18).

The three aquatic environments in the park are lake, slough, and intermittent stream. Blyth and Hudson (1987:16) have noted that the hummocky topography, with its many depressions in which small lakes can form, combined with abundant aspen provide the ideal conditions for beaver.

The traditional name for the area, "Beaver Hills", attests to the area's suitability as beaver habitat, in earlier times. However, by the 1880s the fur trade had eliminated the beaver from the area. In 1907 two beaver were reintroduced into the area. Since no natural increase occurred in 16 years, it was believed they were both male. In 1942 a productive population was established. From 1942 to the present an exponential growth of beaver populations has occurred at Elk Island Park (Blyth and Hudson 1987:142-154).

Study Sites and Methodology

The research carried out in Elk Island National park was not as comprehensive as the studies carried out in the Plains area. However, considerable previous research on the beaver populations in the park provided a general framework for my analyses.

The objectives of this study generally parallel those put forth for the Plains: (a) the determination of beaver habitat requirements, involving the definition of which ecological components act as a restraint or limit beaver population size; and (b) the effects of beaver activities on the environment. The focus in this study, however, was markedly different. As compared to the Plains, surface water resources and treed areas are not limiting factors; therefore, it would be pointless to analyze these factors from that perspective. Open areas, which in turn would be the major sources of terrestrial herbaceous food resources (i.e., grasses and sedges), are limited. Therefore the study examines the role of beaver in establishing and maintaining these areas of food resources.

Two beaver-occupied areas, both associated with sloughs, were selected as research areas. Site A represented an initial and/or early beaver occupancy of an area (Plate 10). Site A was occupied by beaver in the spring of 1989 (Wes Olsen: personal communication), and research was commenced in the area in July. Site B (Plate 11) represents an area occupied for a considerable duration, a minimum of 10 years (W. Olsen: personal communication). This temporal difference allowed for a broader developmental approach to the analysis of beaver behaviour and its consequences. Some water depth measurements were carried out on a stream leading from Goose Lake.

Site A is located on the left and/or west side of a road following the west shoreline of Astotlin Lake and leading to the Administration Centre. The research area was divided into two sections: (a) Section 1, the north-west-facing edge of the slough, which also has a bank lodge; and (b) Section 2, the southeast-facing edge of the slough. In August, in each research section 50 meters were marked off at 10 meter intervals along the slough edge. The research area extended 5 m perpendicular from the water's edge. The site parameters were generally dictated by the beaver's foraging range. In August, all beaver-felled trees were found within 5 m from the slough edge. The exception was on side A2, which in October was extended 10 m from the stream edge to include all the felled trees.

The analyses of the foraging behaviour of beaver was restricted to two species - alder and *Populus spp.* Most of the willow was inundated, so that the extent of beaver utilization was generally not visible. Hazel was not analyzed mainly because use was negligible, and diameters were too small. Skinner (1984:4) notes that when trees or shrubs less then 2 cm in diameter are cut, it is difficult to distinguish beaver markings from snowshoe hare.

Site B is located in proximity to the north shore of Astotlin Lake, and is crossed by a nature trail. In August research was mainly limited to qualitative observations. However, tree diameters (*Populus spp.*) were measured in a single plot (5 m by 20 m) randomly chosen from a sample of five. Measurements were restricted to those trees that appeared recently cut. The plot (area I) was located on the east side of an older section of the pond system. The slough contained two lodges: an abandoned older island lodge, and what appeared to be a recently constructed island lodge which was abandoned by October; no food cache was observed.

In mid-October, at site B, quantitative analyses were approached from a different perspective, and carried out in different areas. A phenomenon observed at site A, that is trees felled by blocks, was also observed at this older beaver-occupied area. Area 2 was located by the bridge crossing the south side of the slough, which contained the active bank lodge. The research area was 15 m by 10 m, representing a general containment of the felled trees. Area 3 was to the east of the lodge, and contained an isolated mature stand of trees; the parameters of the stand were approximately 15 m by 20 m. No analyses were attempted on alder, as its representation in the study areas was negligible. Likewise willow was not identified in any significant numbers.

Beaver Habitat

Schwanke and Baker (1977:25) estimated that during 1975 and 1976 in Elk Island National Park, the majority (143 or 69%) of the active beaver lodges (206) were found in a slough aquatic environment, followed by lake (22.3%), then intermittent stream. They (1977:28) also noted that the most common habitat types associated with active beaver lodges were marsh-sedge wetland bordered by aspen forest (34.5%), and marsh-sedge shrubby wetland bordered by aspen forest (25.2%), for a total of 59.7%. The next closest habitat type was marsh-sedge wetland, grassland, and aspen forest at 8.2%. The remaining 10 habitat types were occupied by 32.1% of the active lodges.

The great abundance of surface water is perhaps the most obvious common feature in the whole research study. Research studies in the park, and generally in most northern areas, have noted the adverse effects of beaver-induced flooding. Beaver appear particularly adept at stabilizing water resources in the slough environment. Unless artificially drained, water levels rarely change in most ponds. Schwanke and Baker

(1977:53), while measuring water depths in proximity to beaver lodges, observed no differences in water depths between the years 1975 and 1976. Water levels do fluctuate to some extent in the lake environment; however, beaver have no control over these fluctuations. In the newly-occupied slough (site A) the initial damming process involved a slow progressive rise in water levels during the season.

Foraging strategies in Elk Island National park have been discussed by several authors. Schwanke and Baker (1977:x) noted that aspen and balsam poplar were the species most commonly utilized by beaver. They (1977:59) further stated that 61% of the above combined species were cut in the 0-6.4 cm class, followed by 9% in the 6.4-8.9 cm class. For comparative analysis, Skinner (1984) grouped active beaver colonies into four age classes ranging from Class 1 (1-3 years occupancy) to class 4 (nine years or greater). He made some broad conclusions, noting that for aspen popular there was no evidence that foraging patterns were influenced by colony age or distance from shore (1984:13).

The current studies found that there are variations in beaver foraging strategies which are strongly influenced by the age of the colony (in this case initial occupancy of area as in contrast to a mature colony), and seasonality. At site A, one of the initial beaver activities was the felling of most of the trees (*Populus spp.*) positioned along the stream edge within the 50 m research area on both sides of the pond. This activity was intensified in proximity to the lodge. Because wastage was excessive, it was concluded that an affinity for open canopy was the causal factor in this beaver behaviour pattern. The affinity for open canopy makes good ecological sense. First of all, accessibility to most of the other smaller diameter trees was contingent upon the removal of the larger forms. Smaller diameter trees tend to become lodged, if the area is not cleared and/or open. Longley and Moyle (1963:35) have similarly noted that wastage is a problem with smaller diameter trees because when cut, they are too light to crash to the ground in heavy forest. Large trees when felled often had the momentum to crash to the ground through most impediments.

During the summer woody species were not generally used as food; at least evidence of extensive use of *Populus spp.* was not visible at either site A or site B. Alder was extensively cut at site A; however, the evidence pointed to leaves, rather then bark, being the source of food. The importance of herbaceous materials in the beaver's diet during the summer has been strongly confirmed by analysis of beaver stomach contents (between April 30 and August 10) by Skinner (1984:55). Herbaceous materials (graminoids and leaves) were the principal components, making up 74.4% of the stomach contents, followed by bark at 17.1%.

Alder was a major component of the woody materials used in lodge construction. Unpeeled willow and some peeled poplar (*Populus spp.*) made up the remaining construction materials, which together gave a diameter mean of 3.1. Skinner (1984:20) similarly noted that recently constructed lodges were smaller than old lodges, and consisted mainly of unpeeled woody material about 3 cm in diameter.

Skinner (1984:34) has interjected a temporal perspective into alder use, suggesting that, "Increased selection for willow and alder in young colonies may result from the use of those shrubs as structural materials." The ecological dynamics are somewhat more complex. The importance of alder as a structural material cannot be denied; however, alder leaves as a source of food may be also crucial to a young colony. Herbaceous materials such as grasses and sedges would be in short supply during early occupancy. A certain time span is required during which beaver have clear-cut a sufficient number of trees to allow for a succession to grass/sedge vegetation. In mature colonies extensive sedge/grass areas would markedly reduce the need for alder as a food source. In Elk Island Park, at most mature colonies, the beaver have created sedge/grass meadow of about 15-20 meter radius around the slough edge. But it should be noted that at site B and other mature sites, the flooded areas or ponds did not provide new willow or alder habitats. In fact these species, with few exceptions, were not observed in proximity to mature beaver ponds. Therefore reduced utilization of willow or alder at mature sites may also relate to unavailability.

There were also significant seasonal changes in the degree of use of some species. At site A, in fall (mid-October), alder use was negligible, mainly because the lodge was built and its bark was not a source of food. At all sites the use of tree species (*Populus spp.*), went up dramatically in fall. The most important reason was the need to construct winter food caches. Some repairs of dams and/or lodges were carried out; however, what was most visible was the marked increase in the use of woody materials (bark) for immediate consumption. At site B, bark was stripped from the upper 1/3 to 1/2 portions of the large trees, a foraging pattern not common earlier in the season.

This new behaviour pattern may relate to the curing of herbaceous vegetation, a process which brings about marked changes in its chemical composition, perhaps rendering it unpalatable for beaver consumption. Clark and Tisdale (1945:20) found that the average chemical composition of five major grass species changed markedly during the growth stage. At leaf stage protein was 18.33%, dropping to 4.85% at the cured stage. Phosphorus dropped from 0.252 to 0.084%, while calcium went from 0.390 to 0.337%. Fiber, on the other hand, increased from 25% to 34.5%. It is this latter change that may have shifted the beaver food preference to woody species.

Skinner (1984) has also focused on fiber content being an important factor in species selection by beaver, noting that, "At Elk Island National Park selection of tree species is strongest for populars, which are characterized by low fibre content" (1984:36). Citing previous literature, Skinner relates this preference to the fact that the ability of beaver to digest cellulose in their diet is low, about 30%. Skinner (1984:39) also suggests that beaver avoid smaller size classes of aspen poplar because of the high toxic levels of phenobes, which are induced by browsing. There may be some validity to the inference that smaller size aspen is not extensively used. In this study, at site A1 in August, 42.6% of the *Populus spp.* population was from 1 to 5 cm in diameter, but only one specimen was cut. However, it must be stressed that, although beaver cut large diameter trees, the bark on the lower portions of large diameter trees is rarely utilized.

In fall (mid-October) an important and significant type of foraging strategy was discerned which had little to do with diameter size or nutritive value. Trees were mostly block cut at all research areas. This feature was particularly evident at site A2 (Plate 12), as spatial control was maintained over a 50 by 10 m area. Of the 19 trees felled, 86% were restricted to a 10 by 10 meter area, while the remaining ones were located at the periphery of this plot. At site B2, 40 or 81.6% of the trees were cut within a 10 by 15 m plot. At B3 (Plate 13), a mature isolated stand, 9 out of 10 trees were cut. Individual trees were still sporadically cut throughout the area, but the above foraging pattern was prevalent. Block cutting is a highly efficient mechanism in foraging strategies as it reduces wastage; i.e., lodging is reduced. The ecological significance of block cutting is that it hastens the succession of treed areas to open areas. The succession to herbaceous vegetation, an essential source of food, is markedly accelerated.

Specific field research to determine what factors affect population movements and population size was not carried out; however, previous research in the park provides many strong clues. As previously noted, since 1942 beaver populations have been increasing in Elk Island Park; and the latest survey in 1988 indicates a continuing increase in beaver populations in certain areas of the park. For the park as a whole, Flato (1988:4) calculated that active lodges increased from 1.57/km^2 in 1986 to 1.61/km^2 in 1988. In other words, it does not appear that the carrying capacity of the park has been reached.

Research in Elk Island National Park also provided some clues on the affects of burning. It was observed that beaver did not appear to fell trees on which the lower trunks had been singed or charred.

The Effect of Beaver on the Environment

In Elk Island National Park, Schwanke and Baker noted that, "The greatest influence of beaver on their habitat is the result of tree cutting and flooding which kills terrestrial vegetation" (1977:xi). Blyth and Hudson (1987:16) have stressed that many surface water bodies in the park are the result of two factors: topography and beaver activity. More specifically, they (1987:18) have noted that, in the north park, surface water cover increased from 0.6% in 1924 to 8% in 1983, while in the south area of the park, surface water cover increased from 3.7% to 7.8% over the same period. They attribute these changes to beaver damming activity and some man-made dams.

What are the initial effects of flooding? Beaver generally create many of the slough aquatic environments by impounding low-lying areas. Low-lying wet locations tend to be willow-dominated shrublands with a heavy layer of sedges and grasses between the willow shrubs (Blyth and Hudson 1987:28) Alder, although not as abundant, would also be a component of the above habitat. Flooding results in the rapid death of the above species. Knudson (1962:9) observed that most tree/shrub species found on floodplains are intolerant of long-term flooding and begin to die after a few months; most are killed after a year of inundation.

The next beaver activity that has a profound effect on the environment is the felling of trees. My current studies indicate that the initial clearing of treed areas may be quite rapid. When beaver first occupy an area a large numbers of trees are felled, particularly in the vicinity of the lodge. An affinity for open canopy appears to the prime causal factor, as non-use or wastage of these resources is extremely high. Second, the block or clear-cutting of treed areas also creates small open areas, within a season, so that succession to herbaceous vegetation is initiated quite early during beaver occupancy. This aspect of beaver activities - that is, initiating the succession from treed areas to sedge/grass meadows - has been observed by many authors. Schwanke and Baker (1977:65) have commented on the positive attributes of these beaver activities, noting that browse and graze production increased when beaver cut down large areas of trees because the canopy is opened up, allowing sunlight to penetrate, thus stimulating vegetative growth.

That beaver activities create grass/sedge meadows is not denied, but that these activities increase browse/grass production is debatable when one considers the area lost by flooding. Schwanke and Baker calculated that the average area of open water in a slough is 1.3 hectares (1977:27), while the mean amount of area utilized by beaver is 0.4 hectares (1977:58). In other words, 1.3 hectares of grass/sedge/shrub vegetation has been lost by flooding, while only 0.4 hectares of open area (grass/sedge vegetation) has been created. In addition, although there is an appreciable replacement of the herbaceous vegetation lost by flooding, such is not the case with tree/shrub species. Throughout the park, willow and/or alder species that were killed by flooding have not reestablished either along the slough edge or higher up. Beaver ponds as they age may develop attributes that inhibit the reestablishment of these species. Knudson (1962) notes that:

> The pH rating of the soil is so low after drainage of the ponds that tree and shrub species cannot invade the basin until the soil is freshened by many years of percolating rain water and snow run-off (1962:14).

Wilde et al (1950:125-126) observed that toxic gases found in the soils of active beaver ponds partially destroy the mycorrhizal fungi on the roots of shrubs and trees. The growth of many trees/shrub species is dependent on the activity of these fungi. It is therefore suggested that the toxic qualities of beaver pond water may percolate or permeate into the soil proximate to the pond, inhibiting the reestablishment of alder and/or willow in the immediate area.

Knudson (1962) also suggests that the morphological nature of sedge/grass communities may be an inhibiting factor, noting:

> ...the sedge-grass community with its fibrous root mat is often so thick that its physical presence alone offers severe competition to roots of tree and shrub seedlings (1962:15).

The above dynamics are increasingly affecting the vegetation composition of the park. For example, as previously noted, Schwanke and Baker (1977) calculated in 1975-6 that marsh-sedge wetland bordered by aspen forest was occupied by 34.5% of the active beaver colonies. By 1986 Leach (1986:13) found that 64% of the active lodges were occupying the above habitat type; meanwhile, the presence of beaver colonies in the marsh-sedge "shrubby" wetland habitat had decreased from 25.2% to 13%. The above frequency differences also hint strongly that alder and/or willow species are not reestablishing in beaver habitats after initial destruction by flooding. From a temporal perspective, the above dynamics reveal a progressive maturing of beaver - occupied habitats; and the replacement of marsh-sedge "shrubby" wetland bordered by aspen forest by marsh-sedge wetland bordered by aspen forest.

Olson's (1987:33) temporal analysis (from 1950-1983) of the effects of beaver activities specifically in the Wood Bison area strongly correlates with the above assessments. He notes that the area covered by Carex (a sedge) has declined by 3%, while the area covered by water has increased from 2 to 9% (1987:33). In addition, large areas of grasslands and willow habitats have been flooded. He calculates that because of beaver-induced flooding, ungulates have lost 450 hectares of food resources. He concluded that, "In all areas of the park, grassland, shrubland and, in the Wood Bison area, sedge meadows are decreasing in area due to encroachment of forest and increased flooding by beaver" (1987:11).

Ecological conditions, however, change dramatically when beaver ponds are drained. Because of the toxic qualities of impounded waters, and the subsequent effect on the pond soils, the invasion of beaver meadows by shrubs and trees is very slow. Knudson (1962:15) found that in drained beaver ponds, with 100% initial killing of trees and shrubs, no woody recovery occurred in the first two to five years. Beaver ponds drained for up to 10 years showed only slight recovery of woody plants, the most common being sparse stands of willow and tag alder. These beaver meadows or drained ponds play an important role in the woodland environment. Not only are they an important source of browse/graze for a wide range of faunal species, but they also affect the distribution patterns of fauna, concentrating them in the vicinity of these areas.

In summary, in a Woodlands biome, treed areas and aquatic environments are abundant. Although beaver create grassland openings, the browse/grass areas lost by beaver flooding markedly exceeds those created by beaver tree-cutting activities, greatly reducing the food resources of ungulates. Beaver populations also have been increasing rapidly. In addition to the fact that beaver have few natural predators, the above conditions, to a large degree, can be attributed to the control of natural fires, and the discontinuance of prescribed firing; important factors in the creation of beaver meadows.

CHAPTER V

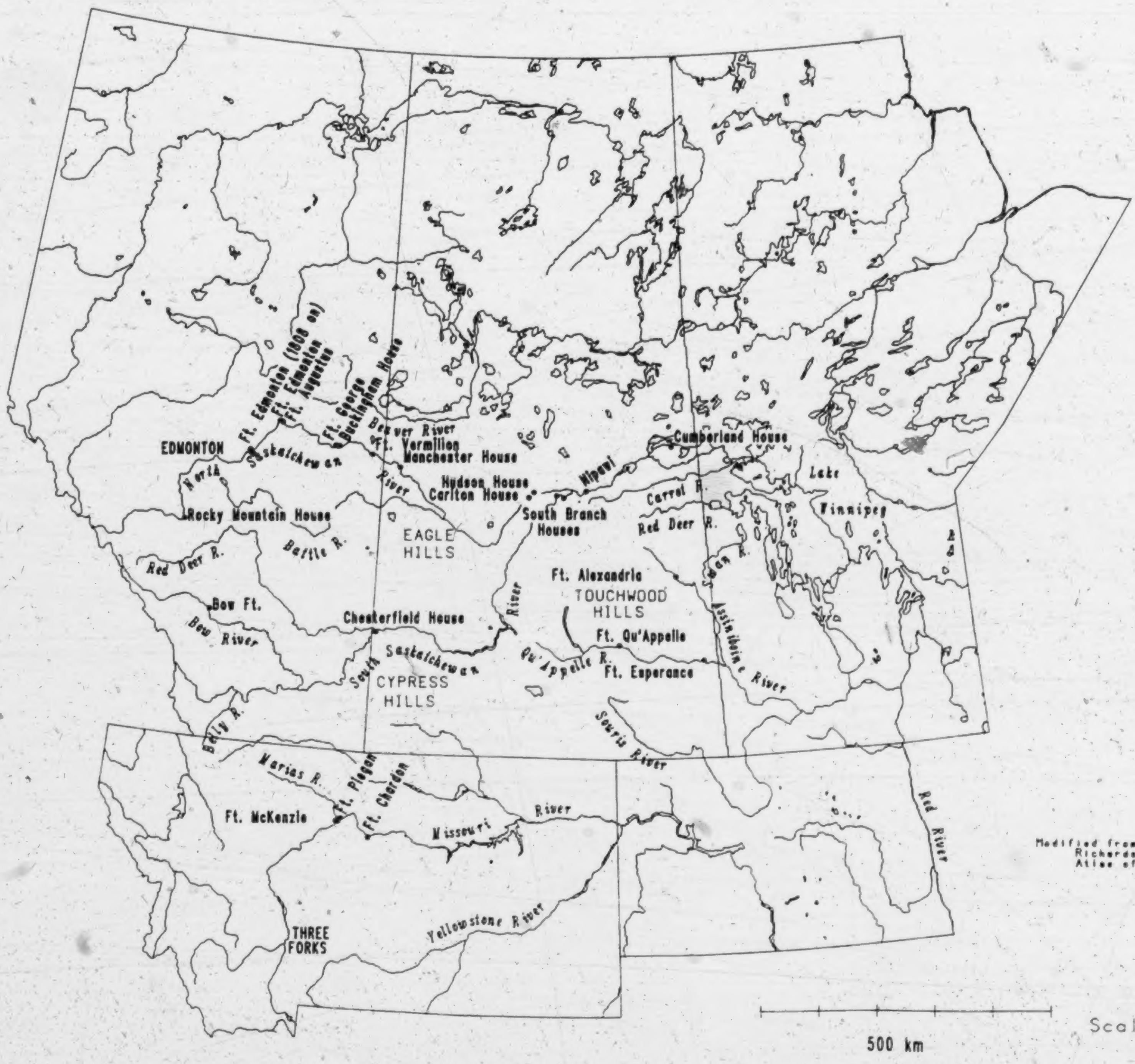
THE HISTORICAL EVIDENCE

INTRODUCTION

The chapter tests the theoretical model mainly from an historical perspective: the evidence from actual relationships and eyewitness observations and/or interpretations. The analysis examines the assumption that the aversion to beaver hunting reached its highest expression in the aboriginal groups entering the plains environment as a pedestrian peoples. Therefore the initial focus in the study is to establish the origins of the various groups, their time of entry into the interior Plains, and their territorial/political alignments.

The time periods under investigation are the Protohistoric and early contact which began in the early seventeenth century, and generally encompasses a time span prior to the establishment of direct trading with the Indians. Towards the latter part of this time period, "Pedlars" (independent French and English fur traders) had begun to infiltrate the Plains starting up direct trading relationships with the Indians. Faced with falling returns, the Hudson's Bay Company decided to establish inland trading posts, the first being Cumberland House, in 1774 (Fig. 11). The main tribal groups under investigation are the Blackfoot Nation (Piegan, Blood and Blackfoot Proper), the Gros Ventre, the Plains Assiniboine and the Cree.

During this time, many changes were initiated which would greatly intensify during the historic period, irrevocably altering the pedestrian lifeways. The acquisition of the horse was perhaps one of the most important events. Its impact will be discussed more fully in chapter VII, which details these changes and explores their effect on traditional relationships ecological and socio-economic relationships.


Ft. Edmonton (1808 on)
Ft. Edmonton
Ft. Augustus
Ft. George
Buckingham House
Beaver River
Ft. Vermilion
Manchester House
EDMONTON
North
Saskatchewan
River
Hudson House
Carlton House
Nipawi
Cumberland House
Lake
Winnipeg
Carrot R.
South Branch
Houses
Red Deer R.
Rocky Mountain House
Battle R.
EAGLE
HILLS
Red Deer R.
Ft. Alexandria
TOUCHWOOD
HILLS
Swan R.
Bow Ft.
Chesterfield House
River
Bow River
Ft. Qu'Appelle
Assiniboine River
South
Saskatchewan
Qu'Appelle R.
Ft. Esperance
CYPRESS
HILLS
Belly R.
Souris River
Marias R.
Ft. Piegan
Ft. Chardon
Ft. McKenzie
Missouri
River
Red River
THREE
FORKS
Yellowstone River
500 km
Scale 1 / 380,000

Modified from Ewers, 1958, pp 42-43.
Richards and Fung, 1969, p9.
Atlas of Alberta, 1969, pp44-45.

Figure 11 Physiography and Fur Trading Posts to 1858

THE PROTOHISTORIC AND EARLY CONTACT PERIODS

According to Ray (1976:12-13), prior to the establishment of the Hudson's Bay Company in 1670 the Assiniboine and Western Cree had been linked to the Ottawa Indian-French trading network, and were considered to be the most important suppliers of furs. He also observed that the construction of company posts on Hudson Bay resulted in a northwesterly movement of the Assiniboine and Cree, as they became middlemen in the fur trade that became oriented towards York Factory.

On the basis of documentary evidence, Ray (1976:12) concluded that in the late seventeenth century the Assiniboine territory reached from the southeast side of Rainy Lake to central Saskatchewan on the northwest. He placed the Cree along the northern border of the Assiniboine territory, and the Gros Ventre on the Upper Qu'Appelle Valley and lower Saskatchewan River.

These tribal alignments, particularly with regard to the Assiniboine, ignore the historically-documented division of the tribe into Woodlands and Plains groupings. Ray (1972:105) does note that these distinctions may have some validity, but also points out that they have been used, ..."to play down, and minimize, the interregional contacts which existed between these groups", which is a central focus in his research. On the other hand, intra-tribal divisions are central to the current study, as they form the basis underlying several important cultural distinctions, including the non-use of beaver.

Joseph La France's travels, beginning in 1739, provide the earliest documentation of the Assiniboine division, and also a broad geographic placement of several of the Plains tribes:

> Upon the West side of Lake Ouinipique [Winnipeg] are the Nation of the Assinibouels of the Meadows, and farther North a great Way, are the Assinibouels of the Woods. To the southward of these are the Nation of the Beaux Hommes [Gros Ventre], situated betwixt them and the Sieux Indians. The Indians on the East Side are the Christinaux [Cree], whose tribes go as far North on that side as the Assinibouels do on the other (in Dobbs 1967:35).

Kelsey's earlier travels, in 1690-91, also hint at this division of the Assiniboine, and more specifically the extent of their western penetration. Travelling with Woodland Assiniboine, who traded at York Factory, he encountered other Assiniboine groups in the vicinity of Carrot River, and as far south as the Touchwood Hills; these latter groups were referred to as the "Mountain Poets", which most likely were part of the Plains division of that tribe (in Doughty and Martin 1929:13). Ray (1976:12) claims that the Touchwood Hills represent the western limits of Assiniboine territory at this time (Fig. 11). Morton (1973:112), however, suggests that the "Eagles brich Indians" that Kelsey also met (in Doughty and Martin 1929:9) were the Eagle Hills Creek Indians (also Assiniboine) from the Elbow of the North Saskatchewan. If this identification can be accepted, then the western extent of Assiniboine territory was much greater.

Kelsey's travels also imply a more northerly placement for the Gros Ventre than suggested by Ray. When Kelsey left the Touchwood Hills he travelled north, according to Morton (1973:113), 127 miles in the direction of Nipawi falls to meet the "Naywatame Poets" [Gros Ventre]. Supporting evidence for this geographical positioning comes from David Thompson (in Glover 1962:239), who states that the former residence of the Gros Ventre, whom he calls the "Fall Indians," was on the Rapids of the Saskatchewan, about 100 miles above Cumberland House (Fig. 11). Kelsey's narrative also indicates that the Gros Ventre appear to be under constant threat from the Cree to the north and the Assiniboine to the east (in Doughty and Martin 1929:17-18). This time period may be indicative of a northwestern displacement of the Gros Ventre by the Assiniboine.

Interestingly, no mention is made of the Blackfoot tribes at this time. As early as about 1723-28, David Thompson's informant (a Piegan chief) had inferred that the Piegan resided in the vicinity of the North Saskatchewan and the Eagle Hills (in Morton 1973:16-17), the region where the Eagle Hills Assiniboine supposedly were located. This territorial positioning of the Blackfoot will be discussed later in association with the Shoshone intrusion into the area. Nevertheless, it is assumed that in Kelsey's time the Blackfeet groups were in a more southerly location from the Assiniboine groups.

Morton (1973:16) accepts La France's tribal division of the Assiniboine, noting that prior to the coming of the Whites, the Wood Assiniboine were north of the Plains Assiniboine. However, when addressing tribal migrations, most authors, including Morton, have dealt with the two divisions as one. Morton (1973:16) states that when the Assiniboine split from the parent tribe, the Sioux, they first occupied the valleys of the Red River and the Assiniboine River. Lowie's assessment of Assiniboine migrations is perceived from a deeper temporal perspective:

> In the middle of the seventeenth century the Assiniboine seem to have inhabited the neighborhood of the Lake of the Woods and Lake Nipigon. Thence they moved northwest towards Lake Winnipeg, where they came in contact with the Cree, and continued their westward migration as far as the Assiniboine and Saskatchewan rivers (Lowie 1909:7).

If we accept the Plains/Woodlands distinction within the Assiniboine tribe, then the question is when did it occur, and could it have evolved from the groups having different migration routes? In part, the answer lies in establishing the separation date from the parent group, the Sioux, a date which has been highly debated. Ray (1976:4) has observed that the historical record implies a separation date ranging from prior to 1640 to as late as 1757. Lowie (1909:8) notes that the argument presented for the separation of the Assiniboine from the Dakota for only a short period just prior to contact is based on the similarity of Assiniboine to other Dakota dialects. Lowie (1909:10), however, argues that the Assiniboine developed at least two sub-dialects after their secession from the Sioux, a fact which indicates a greater time depth than has been suggested. The two groups compared were the Stoneys of Alberta at Morley, and the Montana Assiniboine at Fort Belknap Reservation. More specifically, Morton (1927:90) refers to the Assiniboine at the Morley reserve as Mountain Stony because they lived and hunted in the Rockies, thus placing them in the Woodlands Assiniboine division. The Montana Assiniboine were a part of the Plains division.

With regard to movement patterns, Riggs' observations hint that Assiniboine migrations may have occurred in more than one direction. He notes that:

> ...they [Assiniboine] appear to have been occupying the country of the Red River of the North, probably both on the eastern and western side. Their migrations have been northward and westward (1893:188).

Thus, it is argued that one group, retaining its original Woodland orientation, continued to involve itself with the fur trade. In conjunction with the Cree, northern movements continued along the eastern side of Lake Winnipeg, as this group was drawn to the English posts at the Hudson's Bay. On the other hand, the Assiniboine that were to become the Plains division moved west to the Red River, then along the Assiniboine, eventually becoming established along the lower Qu'Appelle and Souris Rivers.

It is also assumed that the Plains/Woodland distinction represents more then just a geographic positioning of the groups. The movement of the groups through different environmental zones would have led to the development of some cultural characteristics oriented to these zones; in this case, the increasing orientation of the Assiniboines moving west to a Plains environment. One of the earliest distinctions was related to the use of the canoe. In the Woodlands, the canoe was essential for transportation; and with the advent of the fur trade, the only means of contact with the fur-trade forts on the Hudson's Bay. For the Plains Assiniboine, moving along the Assiniboine and/or Qu'Appelle Rivers, the canoe would have been an impediment. As previously noted, the extreme sinuosity of these waterways negated the value of the canoe, as distance could be covered more quickly on foot. The rapid loss of canoe use, and corresponding knowledge of its manufacture, would have severely impeded the movements of all Plains-oriented groups into the Woodlands; and generally acted against direct contact with the fur trade at Hudson's Bay. These travel limitations would also have increased the isolation and separation (at least seasonally) of the two Assiniboine groups, and stimulated the development of distinct dialects. Ray (1976:60) has similarly noted the abandonment of the canoe as a consequence of the developing grassland orientation of many groups.

Ray (1976:59) also observed that, on occasion, the Sarsi and Blackfoot did travel to the posts but always in the company of the Assiniboine and Cree. Ray suggested that they were not permitted to travel to the posts without the escort of the latter groups; however, just as plausible is the explanation that they did not have the means to travel without the help of these groups. The non-use of the canoe as a distinct Plains characteristic was first noted in Kelsey's travels, when he was informed by the Assiniboine that the Naywattame Poets [Gros Ventre] did not know how to use a canoe (in Doughty and Martin 1929:16).

Perhaps the most important distinction between the two divisions, at least with regard to this study, was brought to the attention of La Verendrye. While travelling through the parklands in 1738, he was informed by a group of Cree that he would meet Assiniboine [Plains] who did not know how to kill beaver and whose clothing was made from buffalo skins (in Burpee 1927:301). Kennedy provides additional information on the cultural distinctions between the two Assiniboine groups:

> ...sometime after the seventeenth century there was a noticeable division, probably consisting of a more vigorous western group of buffalo hunters who ranged more and were more warlike, and a more sedentary eastern group who chose to restrict themselves to the lakes and woods regions, living on moose and deer, cooking their wild rice, generally neighborly with the Chippewas and Crees, and eager to trap and trade with the French and English (1961:xxx).

The earliest information on the Blackfoot is mainly derived from the narratives of David Thompson's informant, a Piegan chief Saukamappee (a Cree by birth), whom he met in the winter of 1787-88 (in Glover 1962:240-251). According to Saukamappee (at the time 75 to 80 years of age), when he was about sixteen years of age (around 1723-1728), the Cree, including himself and his father, were asked to aid the Piegan in a battle against the Snakes (Plains or Eastern Shoshone) that occurred on the Plains of the Eagle Hill, which probably corresponds to the contemporary Eagle Hills (Fig. 11). Although the Cree possessed a few guns, they were not used in the battle, the outcome of which was indecisive. The second battle occurred about 1734. During the interval between the two events the Snakes had used horses in their battles against the Piegan. Saukamappee notes:

> ...our enemies.the Snake Indians and their allies had Misstutim (Big Dogs, that is, Horses) on which they rode, swift as the Deer on which they dashed at the Piegans, and with their stone Pukamoggan knocked them on the head, and they had thus lost several of their best men (in Glover 1962:241-42).

In the ensuing battle the Cree and Assiniboine, who had again come to the aid of the Piegan, were armed with 10 guns. Terrified by this new weapon the Snakes fled.

Referencing Saukamappee's narrative, Morton (1973:16) suggests that at this time the Piegan were on the plains around the North Saskatchewan and the Eagle Hills; and the Blood and Blackfoot proper were probably near them. This interpretation places the Blackfoot tribes from about 1723 to 1734 in the Eagle Hills area. This territorial alignment was undoubtedly of short duration. Haines (1938:435) estimates that the Shoshone of Idaho acquired horses at about 1690 to 1700. The early acquisition of the horse allowed the Northern Shoshone to penetrate as far as the Saskatchewan in the early part of the eighteenth century (Murphy and Murphy 1960:294). It is suggested that the Shoshone intrusion into the Saskatchewan Valley brought about the northern displacement of the Blackfoot tribes to the areas referred to in Saukamappee's narrative. Therefore, Blackfoot occupancy of the plains around the North Saskatchewan would have occurred between 1700 and 1734.

The concept of a short-term northern displacement of the Blackfoot groups by the Shoshone stems from the debate surrounding Blackfoot origins. There is a general consensus that the Blackfoot are among the earliest occupants of the Plains. Ewers (1958:6) notes that of all the Algonkian dialects, Blackfoot differs the most in its word formation from proto-Algonkian, and the languages spoken by the tribes located in the Great Lakes region. He suggests that the Blackfoot were the earliest of the Algonkian tribes to move, in prehistoric times, from the Woodlands to the open Plains (1958:7). Kehoe, more specifically, proposes that Blackfoot ancestors, "...may have migrated along the northwestward-trending parkland bordering the Plains, through eastern North Dakota and southern Manitoba to western Saskatchewan" (1981:276). She estimates that the Blackfoot lived on both sides of the Alberta-Saskatchewan border from at least AD 1400. Grinnell (1962:177), however, has proposed a migration from the north for the Blackfoot, from around Lesser Slave Lake. Wissler (1910:18) disagrees with Grinnell, noting that there are no traces of a Woodlands orientation in their traditional culture.

Perhaps the most conflicting reference to Blackfoot origins comes from David Thompson's informants:

> "They [Piegan] have no tradition that they ever made use of canoes, yet their old men always point out the North East as the place they came from, and their progress has always been to the south west. Since the Traders came to the Saskatchewan River, this has been their course and progress for the distance of four hundred miles from the Eagle Hills to the Mountains near the Missouri but this rapid advance may be mostly attributed to their being armed with guns and iron weapons (in Glover 1962:254).

Like Wissler, Thompson noted the lack of evidence of a Woodlands tradition. However, from a short term historical perspective the northern origins could be considered correct; the recently abandoned northern areas might have been the Blackfoot homeland for some thirty odd years. The above ethnohistorical record generally points to an Eastern Woodlands origin for the Blackfoot in prehistoric times. With regard to the Gros Ventre, Kehoe (1981:280) suggests that they occupied south-central Saskatchewan and northwestern North Dakota in the late Prehistoric period, after separating from the Arapaho.

The northern displacement of the Blackfoot by the Shoshone would have resulted in at least a partial encroachment on Assiniboine and possibly Cree lands, if the territorial alignments suggested for Kelsey's time are correct. The Shoshone intrusion no doubt also forced a northern displacement of the Plains Assiniboine, who in their recent migrations had brought about a similar northern displacement of the Gros Ventre. It appears that the Shoshone posed a greater immediate threat than the territorial realignments that were occurring among the Plains groups themselves; as Secoy notes, the threat of the Snake [Shoshone] was sufficiently grave to bring about the establishment of a loose coalition among the Blackfoot, Sarsi, Atsina [Gros Ventre], Assiniboine, and Plains Cree which he called the "Allied tribes" (Secoy 1953:47). The defeat suffered by the Shoshone at the hands of the combined Cree, Assiniboine, and Piegan forces signaled the beginning of Blackfoot movements in a southwesterly direction, driving the Shoshone before them.

These events brought about marked changes in the territorial alignments in the Saskatchewan Valley. For the beginning of the historic period, Morton (1973:19) places the Piegans on the Bow River and along the Rockies (Fig. 12). The Bloods were on the Red Deer River and the Blackfoot proper were on the upper waters of the Battle River, south of what is now Edmonton. Their allies the Sarsi, migrants from the Peace river, moved to the left bank of the North Saskatchewan, while the Gros Ventre occupied the open plains to the south. The Assiniboine claimed the North Saskatchewan, the lower Battle River, and the Eagle Hills. The Cree took possession of the north bank of the Saskatchewan and the wooded country north of it. Ray's (1976:22) 1765 tribal distribution map shows the Assiniboine as also occupying the lower waters of the Qu'Appelle and the Assiniboine Rivers. This geographical positioning probably represents the reoccupation by the Plains Assiniboine of their southern territories following the retreat of the Shoshone. The Gros Ventre, as allies of the Blackfoot, also were able to relocate southward, sharing the Touchwood Hills with the Assiniboine and reestablishing on the upper Qu'Appelle and lower South Saskatchewan Rivers.

The geographic placement of the various historic Plains groups reflects strongly the nature of the resource/ territorial rights among these groups, a placement that could also be inferred on a smaller scale for the prehistoric period. These alignments suggest

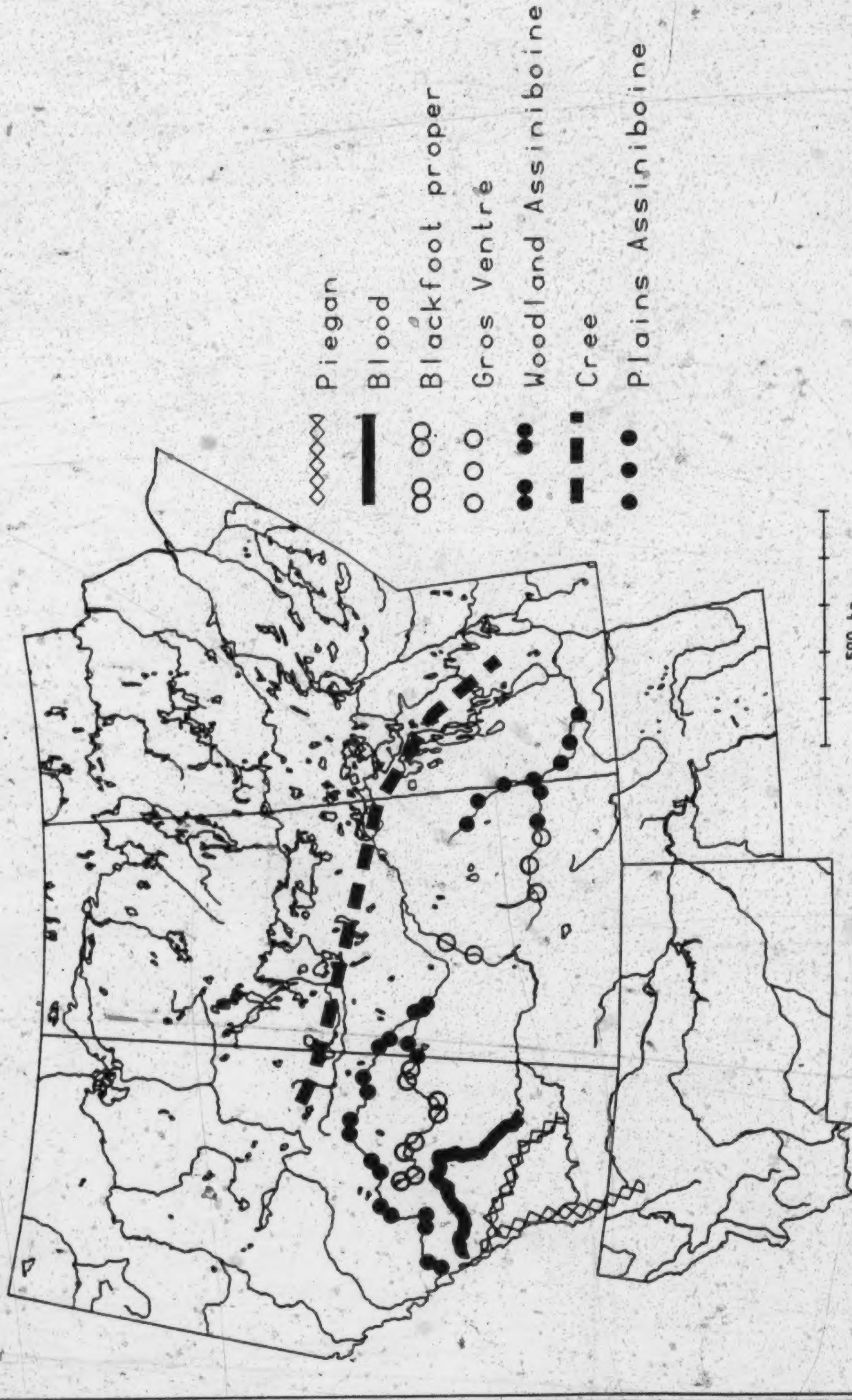

Piegan
Blood
Blackfoot proper
Gros Ventre
Woodland Assiniboine
Cree
Plains Assiniboine
500 km

Figure 12: Tribal distribution at contact

that access to the bison herds was secured by claiming lands on the major river/stream systems in the bison winter range (Fig. 12). It was here that both the bison herds and human populations, prior to contact, were able to remain for up to nine months of the year. In the historic period, Dodge (1959) noted that, "The winter camp is regarded by the Indian himself as his true home" (1959:241). He (1959:50) also points out that the winter camp is considered permanent because of prolonged occupancy, up to five months. In addition, he observed that the Indians regarded the buffalo in their territory as their property (1959:380). The result was that, "Each year, the country occupied by the buffalo became a vast battle-ground, the proper owners attacking the interlopers at every favorable opportunity" (Dodge 1959:380). On the Northern Plains, Morton (1927:84) noted that the limits of the hunting grounds of the various tribes were understood, and that trespass was recognized as an act of war. Exceptions were made for friendly tribes who were allowed to hunt for subsistence needs. Trapping for the sake of furs was forbidden. While travelling in Blackfoot country, Henday (in Burpee 1907:340) noted that although beaver were plentiful, the Indians in his company killed only enough to provide food and clothing. After several attempts on the part of Henday to persuade them to trap more wolves and beaver they replied "...that the Archithinue Natives would kill them, if they trapped in their country" (in Burpee 1907:344). "Archithinue" is a general term for the Blackfoot tribes and their allies, the Sarsi and Gros Ventre (Ewers 1958:25).

On the other hand, the bison summer range remained unclaimed and/or shared by all the tribes for several reasons: (a) the convergence of bison herds from all wintering areas to this range; (b) the greater mobility of the herds during this time of the year; and (c) the relatively short time the summer range was used, from three to three and one half months (Morgan 1979:182). The sharing of the summer range was also pointed out by Thompson, who notes that, "The Stone Indians [Assiniboine], a numerous tribe of the Sieux Nation possess the country southward and westward of this River [Assiniboine], to the Missisourie [Missouri] River, but this latter in common with several other Tribes" (in

Glover 1962:158).

Although the French were probably the first white men encountered by the Blackfoot, Anthony Henday, in 1754, was the first Hudson's Bay man to journey to their territory. By this time the Blackfoot had acquired both horses and guns; and driven the Shoshone back to the Missouri, and the Kutenai across the Rocky Mountains (Morton 1973:18). During the time of Henday's visit the area appeared relatively peaceful, as Assiniboine were seen in the company of the Blackfoot groups, and intertribal trade was flourishing. Intertribal trade during Henday's time gives hints, although confusing, as to the non-involvement of the Blackfoot and their allies in the beaver trade. Henday notes that the Indians told him not to be so concerned about trapping, "...for they would get more Wolves, Beaver &c from the Archithinue Natives in the spring, than they can carry" (in Burpee 1907:344). Although the previous statement implies beaver trapping on the part of the Blackfoot, later in spring Henday notes that, "...our Indians bought a great many Wolves from them [Archithinue] for old axes &c (in Burpee 1907:350). Several days later Henday again confuses the issue by stating, "I bought 30 Wolves' skins from them [the Archithinue], and the Indians purchased great numbers of Wolves, Beaver and Foxes etc...." Interestingly Morton (1973:249), who had access to the original journals, translates the above statement as, Wolves, "Bears" and Foxes; which he describes as the furs of the Plains. The question is, if the Blackfoot groups had beaver pelts for sale, why did Henday purchase inferior skins such as wolves, which just a short time later would be rejected by the French trading post (in Burpee 1907:352)? The answer is: the Blackfoot were not beaver hunters; beaver pelts were obtained from the other groups. Henday does identify the Assiniboine as a major supplier of furs (in Burpee 1907:345). Morton (1973:249) states that Henday, on his route along the North Saskatchewan, was joined by many canoes, which he identified as Woodland Cree and Assiniboine, who were expert trappers and canoe builders. He also noted that the Indians with Henday were both trappers and traders. Henday (in Burpee 1907:353) observed that the Assiniboine that were not going to the

Hudson's Bay gave their heavy furs, that the French would not trade, to Henday's Indians with instructions as to what to trade them for. Therefore beaver pelts and other valuable furs were normally obtained by the Woodlands Cree and Assinibone middlemen from other woodland groups, in addition to what they themselves managed to trap during the winter.

Henday's attempts to convince the Archithinue to come trade at the Hudson Bay were met with a strong refusal (in Burpee 1907:338). He was informed that they did not know how to use a canoe and did not eat fish; and could not live without buffalo flesh, or leave their horses. To Henday's suggestion that they would obtain guns at the Fort, they also replied that they killed their bison with bows and arrows. Ray (1976:75) has observed that traditional hunting favored the continued use of the bow and arrow. The gun could not be fired rapidly, and it could prematurely stampede the herds. Arthur (1975:93), referencing the historical record, also notes that when herds were pounded they were killed with arrows, knives, and lances; and that firearms may have been prohibited. Ray (1976:90) concluded that during Henday's time, European metal goods were the main trade items for the Plains groups, while furs, and some horses, were the main trade items for the Assiniboine and Cree middlemen.

Other Hudson's Bay men such as Joseph Smith and Issac Batt also travelled into the interior and brought back Indians to trade at York Fort (Morton 1973:274-275). However, competition from the "pedlars" was increasing. These were independent French and English fur traders from Montreal who went to the natives and established posts among them (Morton 1973:257). The English policy of waiting for Indians to come to the forts was in serious jeopardy. Andrew Graham, acting chief of York Factory, began to consider that the only way to increase the fur trade was to establish inland trading posts (in Morton 1973:283). Matthew Cocking was dispatched to the interior in 1772 to report on the situation. Travelling with Woodland Cree, Cocking covered much the same area as Henday. He too hoped to find the "Archithinue" Indians and persuade them to come to York Factory to trade.

Cocking's journey provides concrete evidence of Plains-oriented Assiniboine who could not make a canoe or paddle. These Indians also confirmed the use of middlemen (Woodland kin) to barter their furs at the fort. Cocking also encountered Cree who were becoming Plains - oriented: trapping wolves and pounding bison (in Burpee 1908:106).

While in Archithinue lands, Cocking's native companions attempted to repair and operate one of their pounds; however, they were inexperienced and could not drive the herds to the corral. Pounding was obviously a hunting technique that required time and skill to be successful. They also informed him that the trade items obtained from the Archithinue in exchange for European goods included horses, buffalo skin garments, wolves, and other furs (in Burpee 1908:109-10). There is no mention of beaver as a trade item.

When the Archithinue (Cocking identified them as Gros Ventre) arrived at the pound, they successfully carried out a drive, leading Cocking to note:

> Indeed not only at this Game, but in all their actions they far excel the other Natives. They are well mounted on light, Sprightly Animals; Their Weapons, Bows & Arrows: Several have on Jackets of Moose Leather six fold, quilted, & without sleeves (in Burpee 1908:111).

At this time the Shoshone, who were gun poor, were the main enemy of the Blackfoot tribes. Warriors were still armed with bow and arrows, so that leather armour still fulfilled an important function (Secoy 1953:53). The Archithinue again refused to travel to the fort, claiming, like the Plains Assiniboine, the non-use of canoes as the main reason; and also the possibility that they would starve on the voyage (in Burpee 1908:111).

In summary, the early contact period was still a relatively peaceful one; the Cree and Assiniboine were still on friendly terms with the Blackfoot tribes and their allies the Gros Ventre and the Sarsi. There were two main reasons: the continued threat from their mutual enemy, the Shoshone; and the establishment of trading relations between the Plains groups and the Woodland Cree.

During this period observations by Hudson's Bay Company traders such as Henday and Cocking gave important insight into the lifeways of the Plains Indians, and implied the non-hunting of beaver by the Plains groups. The Blackfoot tribes and the Gros Ventre traded furs such as wolves and foxes, some horses, and buffalo skin garments in exchange for metal goods and guns. The Woodlands groups that acted as middlemen obtained the more valuable furs, e.g., beaver, from their own kin, or trapped them themselves. There also were some Cree on the Plains at this time, exhibiting Plains traits such as pounding bison and hunting wolves. At still an earlier period, in 1738, the Plains Assiniboine were already identified as not being beaver hunters.

Interactions between the fur traders and the Indians provided clues as to some of the Plains-oriented traits that had developed: (a) the abandonment of the canoe; (b) the non-hunting of beaver; (c) a primary reliance on bison for subsistence; and (d) the development of communal bison hunting (jumps and pounds). The aversion to beaver hunting was exhibited by those groups which had entered the Plains as a pedestrian peoples: the Blackfoot tribes (Blood, Piegan and Blackfoot Proper), the Gros Ventre, the Plains Assiniboine, and small groups of Woodlands Cree that had moved to the Plains at this earlier time.

CHAPTER VI

THE ARCHAEOLOGICAL EVIDENCE

INTRODUCTION

In previous chapters, the theoretical framework for traditional beaver/man relationships was supported by historical documentation and tested from an ecological perspective, and with important inferences to early human settlement patterns in Valley Complex systems. The regional archaeological analysis is the final and/or concrete test of the primary hypothesis and its corollaries.

Although the definition and location of winter campsites is the primary focus, an accurate understanding of the archaeological record requires a more comprehensive and/or systemic analysis. Within any particular area, in this case the Valley Complex in the bison wintering range, a variety of site types can occur. In addition, archaeological assemblage variability, within sites and between sites, can be expected from a single cultural system, influenced by a range of factors such as seasonality, variations in activities, duration of stay, etc.

A major exponent and initiator of the above principles is Lewis Binford, who states, "...that sites are not equal and can be expected to vary in relation to their organizational roles within a system" (1980:4). Using his ethnographic experiences with the Nunamiut Eskimos as the basis of his analyses, Binford defined two hunting-and-gathering strategies of organization: foraging and collecting. The underlying principle of a forager subsistence strategy is that of "mapping on"; the moving of consumers to resources (Binford 1980:9-15). The basic subsistence strategy for collectors entails the movement of resources to consumers. These "logistical strategies" by collectors solve the problems of spatial incongruity among critical resources. Temporal incongruity is resolved by storage techniques such as drying or freezing (Binford 1980:15). Binford (1980) has also distinguished several site types generated by the above hunting-and-gathering strategies.

Although the Plains bison hunters should also be considered as logistically organized, there are fundamental differences in the logistical strategies between the Nunamiut and Plains hunters that limit the degree of applicability of Binford's model of settlement patterns. The problem lies to a large extent with Binford's choice of the Nunamiut as his subject group. Binford himself refers to them as an "extreme case" in both their logistic and storage characteristics, noting that they obtain more then 70% of their yearly food during approximately 30 days, during the spring and fall caribou migrations (1979:255-256). As a result they consume food out of storage during much of the year.

There is, however, one important broad parallel between the two groups. Like the Nunamiut, the subsistence base of the Plains bison hunter was overwhelmingly dependent on one resource: migrating herd animals. However, the temporal incongruities caused by the migratory nature of the herds were handled very differently. The Nunamiut responded to this environmental condition by intercept hunting strategies in spring and fall, necessitating a heavy reliance on stored food for the rest of the annual cycle. The Plains bison hunters, faced with the same problem and/or environmental conditions, chose to follow the bison herds on their annual migrations between the summer and winter range (Morgan 1979), thus reducing their dependency on stored food.

The above discussion points out that different groups may make different, but equally viable, choices in response to similar ecological conditions. Residential mobility was also much greater among the Nunamiut - seven to nine relatively minor moves in an annual cycle (Binford 1983:381). In contrast, the Plains bison hunters made only two but major residential moves; to the bison summer range in spring, for a period of about 3 to 3 1/2 months; and back to the winter range where they could be found during the fall, winter, and early spring (Morgan 1979). There was also a very localized shift of the residential base in the spring, from the wintering areas on the valley bottoms to higher elevations (Morgan 1979).

The reduced mobility associated with the Plains groups stemmed from the fact that they were not only collectors but "manipulators" of resources. Knowledge of bison behavior allowed them to manipulate bison herds to strategic areas near their residential bases, where communal hunting techniques could be carried out. Knowledge of the cause/effect relationship between bison and fire allowed them also to use fire as a manipulative mechanism for maintaining and concentrating herds in the same areas for continued resource utilization. The above manipulative abilities enabled the Plains bison hunters to prolong significantly the length of occupation of their residential bases in or in proximity to the Valley Complex, which, as previously discussed, provided the optimum conditions for survival, particularly during adverse climatic conditions.

In spite of the differentials in logistic strategies, the Plains bison hunters did generate sites that exhibited similarities to some of Binford's types (Nunamiut-derived), which will be discussed more fully in the site type classification. Studies of settlement patterns have been attempted by other authors such as Greiser (1985), who compiled an overview of hunter-gatherer subsistence and settlement strategies on the Central High Plains. The time frame, however, is much earlier than that chosen for this study; and the analyses are very broadly focused. She notes (1985:121) that during the Pre-Boreal and Boreal episodes (8550-6500 B.C.), campsites occurred along river and stream terraces and in sand dune fields; but for the Sub-Boreal (2730-950 B.C.) more favorable environmental conditions on the Plains resulted in a wide array of settlement choices. An important but more specific study of settlement patterns was carried out in southwestern Alberta by Michael Quigg (1974) in the valley of the Belly River, which presents parallels to some extent to ecological conditions in the Qu'Appelle River valley. He concluded (1974:39) that from 1000 B.C. to A.D. 1850 the Belly River valley was primarily occupied in winter by nomadic hunting groups. He pointed out almost the identical ecological conditions stressed by this study that made the Valley Complex the ideal winter habitat, noting:

> The geographic setting of the Belly River valley would make it a prime location for winter camps. It is well sheltered from the winter winds and provides an

> abundance of water and wood for fuel and shelter. Game congregated in the valley areas in the winter thereby affording readily available food sources. Bison, in particular, tended to winter near the foothills (Quigg 1974:33).

Given that the Valley Complex was the major source of limiting resources such as wood, water, and shelter, it would therefore be a focal point in subsistence strategies and/or settlement patterns of Early Plains groups, influencing not only the type of archaeological sites that were generated, but their distribution patterns.

RESEARCH OBJECTIVES

The specific hypotheses put forth in relation to settlement patterns were two-fold; that is, having both ecological and archaeological components; and from a temporal perspective, given the occurrence of the ecological dynamics, then the archaeological component should be present. Therefore the more specific objectives of this chapter are to examine the following hypotheses:

1. Since the most favorable environmental conditions for winter habitation, i.e., adequate surface water supplies, shelter, and wood, were most frequently found in large tributaries, large winter camps and kill sites should reach their greatest frequencies in these areas.
2. In the small/medium-sized tributaries limited surface water supplies, particularly during drought, should have prevented most areas from being used with any degree of permanency by human populations. Temporary campsites should be the most common site type.
3. In the main valley, inaccessibility to treed areas (with wood and shelter), due to the considerable extent of the floodplain, would generally act against its suitability as a wintering area for human populations. Therefore temporary campsites should be a major site type in the area. As a seasonal source of supplementary food resources (fish), special-purpose sites reflecting seasonality should also occur.

In the reconstruction of the settlement patterns the sites identified will be analyzed from several perspectives:

A) Analysis of the cultural manifestations associated with the sites, which will entail an examination of the following aspects:

(i) The nature of the cultural materials; i.e., the range of artifact types, raw materials used, etc.

(ii) The spatial distributions of cultural materials

B) Analyses of the ecological conditions associated with the sites includes a study of the following factors:

(i) Availability of surface water resources; i.e., presence of beaver ponds

(ii) Aspect of slope

(iii) Natural vegetation

C) Ethnohistorical information pertinent to site type identification.

STUDY SITES AND FIELD METHODS

The Survey

The different size waterways chosen for the archaeological analyses are as follows:

a) Qu'Appelle River (main waterway)

b) Wascana Creek (large tributary)

c) Cottonwood Creek (medium-sized tributary)

Unfortunately it was not possible to use Wascana Creek for both the ecological and archaeological studies; as previously noted, its water resources were severely disturbed by the city of Regina. Because of these frequent disturbances, (marked fluctuations in stream flow and depth) erosional activities along the stream are pronounced. As a result, the contemporary spatial positioning of the waterway on the valley floor is of very short temporal depth. Most archaeological sites tend to be located along oxbows or dry stream beds.

Archaeological surveys were carried out on both Cottonwood and Wascana Creeks. The survey of the Cottonwood Creek valley was carried out in the summer of 1986; and included the area from the C.P.R. dam to the confluence with Wascana Creek (Fig. 13), for a total of 38.5 river km. The Wascana Creek survey was carried out during the summer of 1988; and includes the area from EcNe-6 (near sewage plant) to the bridge just past the Gilmore site (EdNe-11), for a total of 37.6 river km. The main Qu'Appelle waterway was not surveyed; however, a survey of the area was previously carried out by Arthur et al (1975), upon which the analyses will be based.

Because the field research was almost regional in scope there were many constraints, such as limited funding, time, and personnel, that acted against the survey being as thorough or comprehensive as would have been desired. Analyses were also handicapped by the fact that little previous archaeological research had been undertaken in the designated research areas, and information from most of the recorded sites was extremely sketchy. As a result most sites had to be resurveyed; and because the geographic descriptions of some of the recorded sites were extremely vague, they were not found.

The general focus of the survey was on the floodplains and associated terraces, where it has been postulated that winter campsites are most likely to be found. Some surveying of the uplands was carried out but this was not extensive, as many of the previously recorded sites tended to be located on the exposed uplands. These sites are highly visible because of erosional activities.

The Artifact Assemblages

Available cultural materials from the research areas were restricted almost entirely to surface collections held by the Saskatchewan Museum of Natural History and the University of Regina. Previous excavations were limited to the Gilmore site (EdNe-11), also a kill site area partially excavated by the University of Regina. The importance of surface artifact assemblages in finding sites and determining excavation strategies has long been acknowledged; however, surface collections are being used increasingly as a source of primary data for confirming important research questions (O'Brien and McDaniel 1982:217). More specifically, Lewarch and O'Brien (1981:320) state that intensive surface collection is an important contributing factor to solving site - specific problems such as:

a) predicting the presence or absence of subsurface nonportable remains such as pits and hearths;
b) defining "site" boundaries;
c) determining intra-site growth patterns;
d) locating functionally distinct activity areas;
e) locating residential versus non residential areas; and
f) defining settlement functions.

Many of the sites in the research areas, particularly on Wascana Creek, were found on land which has been under cultivation for many years. The effects of tillage have been discussed by several authors, but a recent study by Odell and Cowan (1987) suggests that data retrieval at best would be at a highly generalized level. They studied the effects of tillage on the archaeological record by compacting 14 tillage episodes into two years. They found that plowing doubled the area of the site, while progressively decreasing artifact densities (1987:481). They also observed that "...beginning with a uniformly distributed pattern, tillage in general randomized the distribution of objects brought to the surface" (1987:481). These results suggest that estimations of artifact densities and distribution patterns on fields cultivated for prolonged duration should be attempted only at a gross level; i.e., the site type as the test unit. It could also be assumed that tillage exposed a random sample of the artifact materials associated with a specific site.

In this study the definition of site types, although focusing primarily on environmental attributes and ethnohistorical information, would be greatly enhanced if site type attributes could be distinguished by their archaeological assemblages. The range of artifact types, artifact densities, the raw materials used, etc., are all important attributes in establishing the diagnostic characteristics of the individual site types; e.g., kill site, winter campsite, etc. The common goal, therefore, is to obtain a surface artifact assemblage that was representative of whatever unit (e.g., site, region) is being tested. For density studies a certain degree of spatial control is also essential. Unfortunately there were obstacles that prevented many of these goals, particularly spatial control, from being met. Many of the sites, particularly on Wascana Creek, were in crop, a situation which normally would have made most analyses impossible. However, because of the drought, growth was minimal and erosional activities were intense, which provided a unique situation of many artifact materials being exposed between the crop rows. These conditions allowed for broad visual distinctions to be made as to where concentrations of artifact materials were occurring. Actual site size was difficult to discern, being generally defined by the extent of the plow zone. Density studies again were generally out of the question, as artifact recovery with spatial control was not possible.

However, using the site as the research unit, several crop rows were carefully walked for the extent of the site to obtain a nominal representative sample of the range of artifact types present and raw materials used. Most artifacts were left in situ. Bone and FCR (fire-cracked rock) were not collected. Bone materials, and to a lesser extent FCR, were considerably fragmented, suggesting no data base would be served by their removal.

Most sites were highly disturbed, being under yearly cultivation for over 50 years; so lateral and vertical displacement must be considered as significant. Most of the sites in the valley bottoms were also multicomponent sites so that several cultural traditions were often distinguished in the surface collections, verifying that vertical displacement by tillage was pronounced.

In the Wascana Creek valley, there were site disturbances more destructive than agriculture, so that most artifact collections at best would be considered as salvage operations. For example, one site was discovered because of massive earth displacements occurring during the construction of a picnic area. Another site was an eroding green on a golf course, while several were located in a park topographically altered for motorcycle trails. One sample was fallout from an eroding stream bank.

On Cottonwood Creek, site discovery was hampered by lack of disturbance. Many areas still maintained natural prairie, so that site potential was often indeterminate. The extent and nature of several of the sites was assessed by the evidence being exposed by rodent holes. Also many previously cultivated areas were converted to pasture. However, because of the drought, growth was minimal and erosion extensive; and combined with the effects of over-grazing, many artifact clusterings became partially exposed. These artifact clusterings or activity areas, distributed over a large area, were diagnostic of a specific site type. To obtain a representative sample, a block provenience of a 5 m by 5 m square was placed over several of these clusterings; and all lithic materials were removed from within this context. Also a gridded surface collection with a block provenience of 2 m by 2 m square, within which all cultural materials were collected including bone and FCR, was also carried out on Cottonwood Creek at a site (Thompson II (EdNf-32)) which was possibly a wintering area. Generally artifact materials were left in situ.

Although artifact collections found during the survey were not extensive, there were several previous collections that provided a comprehensive view of the range of artifact types and frequency distributions of worked tools that might be expected to be associated with the site types. On the bases of these collections, and drawing on my previous attempts at categorization, an artifact classification system was established (Appendix III). The classification is based on a hierarchical system, beginning with the industry, then subdividing into series, classes, and subclasses to the final category type. In the Chipped Stone Industry there are 26 possible variations of tool types. The classification system provides the means for testing the range of tool types associated with each site type.

The large number of sites and artifacts precludes individual descriptions of artifacts, so that only the general attributes of each category are presented and examples photographed (Plates 16-22). When a site yielded a sufficient number of artifacts, they were incorporated into the classification system (Tables 6-35). Individual site descriptions, including their artifacts, are found in Appendix II.

Although lack of spatial control acted against any precise density or frequency studies, some basic trends did emerge. Site types showed marked differences in the range of artifact types, and the frequency representation of the stone industries also varied significantly between site types. Trends in raw materials preferences were also discerned. In the site type analyses some of the inferences are speculative, especially those pertaining to the artifact assemblages; and should be considered as hypotheses to be tested with additional archaeological field work of a more controlled nature. However, in any initial attempts to construct a model and/or framework for human systems, a broad and general spatial stage is required within which the fluidity, complexity, and varying intensities of human interactions can best be perceived.

THE SITE TYPE CLASSIFICATION

Introduction

Several authors have attempted to distinguish site type categories for hunter/gatherers, deriving evidence from a wide range of sources. Drawing on his ethnographic experiences with the Nunamiut Eskimo, Binford (1980:9-12) has distinguished the following site types that would be generated by collectors; that is, hunter and gatherers with a logistically organized subsistence system:

1) Residential base - defined as the hub of subsistence activities. From the residential base logistically organized small task groups move some distance away to selected areas for procurement of specific resources.

2) Location - where extractive tasks are carried out. As examples, Binford suggests communal Plains bison kills, Nunamiut spring intercept caribou kills, and camas procurement locations.

3) Special-purpose sites which include: a) station, which is further subdivided into

observation posts, ambush locations, and hunting stands; b) caches, which are temporary storage space in the field; and c) field camp, where a hunting party is maintained while away from the residential base. He points out, however, that within each class further variability will occur relating to the season and the character of the resources used.

Using criteria such as the physical setting of site, archaeological features, the toolkit, and biotic characteristics, Greiser (1985:46) has defined four major site types for the hunter/gatherers of the High Plains. Her campsite category is analogous to Binford's residential base; and like Binford, she stresses that the focus of activities is on maintenance rather than extractive activities. She notes that an important attribute of a campsite is the variety of activities, but also found that the degree of variability is dependent on the length of occupation. She also states that, "Campsites are generally located near water, and depending on the climate, sometimes near a fuel source and shelter" (1985:47). Her kill site category, as compared to Binford's location, is more restricted, referring mainly to mass kills of large faunal forms (i.e. mammoths, ungulates). Her kill sites are also more area-specific, being associated with a "natural" or contrived trap. Kill sites are also exclusively extractive, with main activities including killing of animals and primary butchering (Greiser 1958:47). She introduces a new site category, processing sites, which are locations to which meat packages are transferred from a nearby kill site (1985:48). She also considers these sites extractive, with activities including secondary butchering of large amounts of meat. The fourth category is the quarry site, which she states is located at the source areas for lithic raw materials (1985:48). The entire band as well as a specific task group may locate to a quarry. Main site activities include extraction of materials from the matrix, and initial tool manufacturing. Binford (1979:260), on the other hand, states that the procurement of raw materials was often embedded within some other strategy. In other words, there is no necessarily deliberate intent on the part of a group to go out into the environment with the exclusive purpose of obtaining raw materials for tools.

Greiser (1985:48) does caution that site categories are not mutually exclusive; that butchering activities from kill sites may overlap into processing sites, which in turn may overlap into campsites. She broadly cites topographic situations, number of animals involved, and environmental factors as affecting degree of site overlap.

Quigg (1974:51) has distinguished four site types in the prehistoric settlement patterns of the Belly River valley of southwestern Alberta. However, he does not elaborate on site type attributes. Again, kill sites and campsites are important types; but he lists two additional site type categories which are commonly recognized in Plains archaeology: tipi rings and cairns. The importance of Quigg's research and excavations lies in his recognition of the importance of seasonality in site patterning; and more specifically, as previously noted, the definition of a winter campsite, both from an environmental as well an archaeological perspective.

The above classification systems provide a broad comprehensive view of the type of sites that could be generated by hunter/gatherer groups on the Plains. In the following study the definition of site types will be attempted within the framework of the annual cycle of the Northern Plains bison hunters, in which many factors, some highly specific, strongly affected settlement patterns, generating site types that may have some commonality with the above classification, but also some that are distinctive. For example, bison migrations, which in turn influence major human movements, generate site types that are distinguished not only by seasonality, but by regional positioning. Cultural factors, such as the ability to manipulate bison resources, also strongly affect inter-site variability. The higher degree of specificity involved in this study has also resulted in substantial subdivisions of the above categories, as well as omissions; and as previously stated, the generation of new site categories.

Briefly, the general categories of residential base/campsite and location/kill site are acceptable site types; but only in the broadest sense. Major human movements between the bison summer and winter range have resulted in two distinct, major residential phases, with regional environmental contrasts involving seasonality. The resulting subdivisions are winter/summer campsites and winter/summer kill sites.

Tipi-ring sites have generally been considered problematic, and the usual paucity of cultural materials has led to site function analyses often being highly speculative. There does appear to be a general consensus that a major function of the rocks is to anchor tipis (Kehoe 1960:468; Quigg 1978:30; Frison 1967; Adams 1978:106; etc). Since the site analyses are focused on the bison winter range, processing sites were excluded from the site type classification, the assumption being that processing sites would not be easily discerned because during the winter they were not operative as a separate spatial entity. It was concluded that, because of the frequent inclement weather, some primary, but most secondary, butchering was undertaken at the residential base or winter campsite. A new category, generated by major movements between the bison winter and summer range, is defined as a temporary campsite which is used repetitively. Binford's concept of special purpose sites can be utilized in the classification system with minor adjustments and some omissions. On the Plains, the site category "station" would be restricted to one type, the observation post, which is used for monitoring herbivore movements. The other station types, i.e., ambush location and hunting stands, are less applicable; they appear more group-specific, relating to Nunamiut intercept hunting of caribou. The field camp is a legitimate site type among the Plains bison hunters. Caches would be somewhat synonymous with cairns, being storage facilities.

In the Cannon Reservoir region of Missouri, O'Brien and McDaniel (1982:250), using surface collections to determine site artifact densities and frequencies of artifact classes, were able to make predictions regarding site functions. Given the above, they identified two site types, residential, and procurement - processing. These site type attributes were drawn upon in the following analyses, and will be discussed more fully in that context.

Artifact assemblages were used when possible to substantiate the above site type categories. However, as previously discussed, in the study area artifact assemblages were almost entirely restricted to surface collections with minimal spatial control. Another major problem in the study area was that most collections were from multicomponent sites in which vertical displacement, by tillage and/or erosion, were marked - the cultural components were mostly mixed. However, analyses of the technological inventories and subsistence patterns of the prehistoric peoples under study (Middle and Late Prehistoric) provide little evidence to suggest that there were marked variations in their responses - at least in these aspects - to their immediate environments. That some changes in the artifact assemblages occurred is not denied. The introduction of the bow and arrow and the development of ceramics as well as stylistic changes all made their impact; but it is inferred that none of these dynamics were of sufficient intensity to alter the factors generating site type differentiation. Therefore, the main diagnostic attributes associated with, for example, a winter campsite, would be reinforced by each resident cultural grouping. Quigg's studies of winter campsites in the Belly River valley noted that: "while parts of the artifactual assemblages changed, a basic continuity in environmental utilization patterns persisted for at least the last 2,000 years..." (1974:39).

No one has been more insistent than Binford (1980) in stating that subsistence strategies are linked to environmental variables which in turn provide predictable patterns of archaeological remains; i.e., site types. That perhaps he has overemphasized this perspective is not denied. Wiessner (1982:172) has been particularly critical of Binford, claiming that major differences in the social organization of hunter-gatherers are the result "...of adaptive strategies which relate persons in social relations of production". She does concede, however, that the range of site types within a settlement system, the location of sites, the content of assemblages, etc., may be largely the consequences of direct organization around resources. She goes on to state that "data concerning internal site structure, profiles of exchange, stylistic variation in artifacts,contents in burials, etc., are the products of intragroup and intergroup interaction" (1982:172). However, it is the former aspect which she conceded to environmental influence that is the focus of this study.

Again site type analyses will draw on a range of sources; ethnohistorical research, ecological conditions, and previous archaeological literature. The model for a winter campsite will be the Garratt site, which I previously analyzed extensively (Morgan 1979).

Campsite Types

Temporary Campsite

A major attribute is that site use is of short duration, generally an overnight stay, resulting in only a few, short-term activities being carried out. Therefore artifact densities are low, and the range of artifact types is limited.

This category can further be subdivided into frequent and/or infrequent use camps, based on the premise that deposition of cultural materials, during repeated use of an area, was horizontal; that is, campsites were rarely reused. Therefore infrequent use is characterized by low artifact densities over a small area, while frequent use would be distinguished by low artifact densities over a larger area. However, the artifact materials within the site have a rather specific structural and compositional pattern: small clusterings or concentrations of cultural materials, consisting primarily of bone, FCR, lithic debitage, and an occasional tool. In a site designated as an infrequent-use camp there would have been only one (single event), or maybe two, or three clusterings occupying an area. In contrast a site designated as a "frequent use" camp, would have a larger number of clusterings, spread over a greater area.

(a) Frequent and/or repetitive use camp: From a functional and locational perspective there is only one site type within this category. It is assumed that sites associated with repetitive use had more favorable and/or specific attributes that attract habitual use. It is inferred that sites of this nature, found in the valley bottoms, functioned mainly as temporary stopovers during fall movements from the summer range to the wintering areas in the larger tributaries. These sites must consistently provide water (particularly limited in fall) and wood, which translates into beaver occupation as the guarantor of these resources. These sites were generated by an entire social group; and were often in an open area on the floodplain, suggesting shelter is not a primary prerequisite. Artifact densities tend to increase towards the stream edge.

(b) Infrequent use camp: Temporary camps which are infrequently used would tend to be in random or situationally chosen locations; that is, movements were not planned and/or directed in anticipation of the site's use. These sites were most often generated by smaller groups such as hunting parties that made short trips from the residential base to collect alternative food resources; i.e., deer, elk, waterfowl. In the wintering areas, these sites would be found along the valley bottoms in proximity to the stream edge. Length of stay could have been even shorter than overnight. Artifact remains thus would be scant. This site type correlates strongly with Binford's category "field camp", which he defines as a temporary centre where a hunting group sleeps, eats, and generally maintains itself while away from the residential base (1980:10-12).

Another temporary camp variation in this category would be generated on the prairie uplands, being the result of the manipulation of herds to the drive area of the kill site. Peter Fidler on December 28, 1792, noted, "The Young Men sleep out all night in general - when they bring the Buffalo to the pound - and sometimes they will bring whole herds above 40 miles off and sleep two or three night according as they drive them in a direct manner or not towards the Pound..." (in Forbis 1962:63).

Artifact assemblages of temporary campsites

Regardless of initial purpose, the on-site activities of the temporary campsite would not differ greatly. The main site activity would be food preparation and cooking. Procurement of food resources, and primary butchering, which entails the partitioning of the carcasses into portable portions, under most circumstances would occur elsewhere. Secondary butchering and processing focusing on the preparation of food for consumption would occur on-site.

Because the artifact materials would be accumulated over such a short period of time, densities are low and clustered, and the range of artifact types is restricted. Binford defines an assemblage of this nature as a "...fine-grained resolution between debris or by-products and events" (1980:17). Most of the lithic assemblage can best be defined as "situational gear", which Binford notes is "...that which is gathered, produced, or "drafted into use" for purposes of carrying out a specific activity" (1979:264). He goes on to observe that, "...there is little investment in the tool-production aspects of "situational gear"; edges are used if appropriate, minimal investment is made in modification, and replacement rates are very high if material is readily available" (1979:267).

The core and spall tools in the Cobble Stone Industry (Appendix III, Plates 20-22) generally fall into the above category. They most often functioned in tasks requiring strength and endurance such as initial lithic reduction, primary and secondary butchering, vegetal reduction, etc. Because they are large, they were generally not portable. However, the raw materials, i.e., cobbles, are not only ubiquitous but abundant in the area.. Therefore these tools could be easily discarded and replaced when the need arises.

More specifically, the tools most often found on the sites are primary or secondary decortication spalls, end cores and hammerstones. A small number of Chipped Stone tools also may be found. The associated General Debitage category, therefore, generally exhibits a high frequency of better quality lithic material such as chert. Again, FCR and bone occur in small clusterings.

Wheat's (1978:89) description of a short-term campsite, at the Jurgens site in Colorado, provides some parallels to the above definition. He also notes that artifact and bone densities are low; and that the number of lithic artifact types is restricted, with scrapers and projectile points being the most common. He also observed that quartzite is the most abundant raw material in the lithic debitage. However, some flakes made of better quality materials were also present.

Winter Campsite

The previous chapter discussed the ecological conditions, including beaver activities, that pointed to the Valley Complex, (particularly the larger tributaries) as providing the most favorable conditions for human winter habitation, especially during adverse climatic conditions. More specifically, it was determined that within the large tributary, there was a particular habitat configuration that most consistently provided the essential resources of water, shelter, and wood. This configuration occurs when the waterway approaches a treed northern exposure slope; and when water resources are of sufficient quantity so that beaver can maintain their dam/pond systems, guaranteeing not only the availability of surface water supplies, but the accessibility of the other essential resources during adverse climatic conditions.

Ethnographic studies also give information, although of a conflicting nature, as to the possible size of a winter camp and duration of stay. Earlier studies of Plains lifeways stressed a dispersal of the bison herds in winter, with a corresponding scattering of the bands (Wissler 1911:20, 1918:258; Oliver 1962:54). Ewers in his studies on the Blackfoot also claimed that the bands wintered separately, yet he goes on to make the somewhat contradictory statement that:

> "many of them tended to select the same river valley, the individual bands strung out along the course of that river for many miles at intervals of a few miles or less (1973:17-18).

Arthur's (1975) comprehensive research of the historical record strongly contradicted the above observations. He concluded that,

> In early fall, after the rutting season, the bison moved onto their winter range where they tended to form larger, more sedentary herds and aggregate herds, thereby permitting the formation of large Indian encampments in the vicinity of these herds which were exploited by the use of traditional bison drive methods throughout the fall and winter (1975:121).

Arthur has also made some attempts to determine the actual size of these camps. He notes (1975:111) that Peter Fidler, in January, 1793, reported that a large camp of 220 tents consisting of Piegan, Blackfoot, Sarcee, and Cree were pounding bison. Using Ewer's (1955:139) estimates of eight persons per tent, Arthur calculated that 1,760 people were camped together. Historical documentation consistently provides supportive evidence for Arthur's observations. Henry [the elder], in mid-February 1776, indicated that the Assiniboine, who were pounding bison, had a village of about 200 tents (1969:295). Peter Fidler's journal entry of January 15, 1802, for Chesterfield House, while commenting on the Fall Indians [Gros Ventre], noted that "the whole nation is at three pounds" (in Johnson 1967:307). Dodge (1959) not only stresses the existence of large winter camps, but suggests that several tribes may share a wintering area. He notes (1959:245) that Custer in December, 1868, attacked one end of a camp of Cheyennes, Arapahoes, Kiowas, and Comanches, which extended for more than twenty miles along the Washita River. More specifically, Dodge found that environmental factors such as the nature of the stream or the level of valley can affect the structuring or residential patterning of the winter campsite area, the result being that, "One winter a camp of one hundred and fifty lodges will occupy scarce a mile, another winter it may be extended four, five or even six miles along the stream" (1959:242-245).

The ethnohistorical record also provides valuable insights into the length of occupancy of a winter campsite. Dodge (1959:50) suggests that winter camp occupancy ranged from three to five months duration. According to Ewers, "Generally the Indians spent between five and six months in their winter camps, from late October or early November to late March or early April" (1973:18). In chapter III I remarked upon a major difference between historic and prehistoric groups, as to when occupation of the winter camps occurred. In the historic period, the horse provided the means for exploiting the concentrated bison resources that occurred during the rut. In the prehistoric period, rut activities would make hunting techniques of any nature extremely dangerous for a pedestrian people. It was estimated that sometime around mid-August the summer range would have been vacated by the prehistoric human populations.

Kehoe's informants provided more specific information on winter camp locations and the time of spring evacuation. One informant noted that:

> When you see these tipi rings along the creeks and in the valley bottoms, they are the winter camps. In the spring when it floods they move up on the benches and high ground (in Kehoe 1960:433).

Another informant stated that "...our people camped in the brush of the sheltered valleys near the buffalo drives in the winter" (1960:433). Spring runoff in the Moose Jaw River (a larger tributary) most often begins in mid-March and peaks in April. Therefore on the basis of the above ecological and ethnohistorical information, occupation of the winter campsites, prior to contact, should have generally occurred from mid-August to mid-March, a period of approximately seven months. Arriving at the winter range at the latest by the end of August relates to the crucial need for dependable surface water resources. As previously noted, snow, the alternate source of water resources, does not occur in sufficient quantities until mid-November.

There is also some evidence that human groups tended to return to the same wintering areas. In his studies on the Blackfoot, Grinnell notes that "In the early autumn, all the pis'kuns [pounds] were repaired and strengthened, so as to be in good order for winter" (1962:234). Arthur has also stated that "Annual herd movements into specific localities over long periods of time occurred with regularity when we consider that many bison pounds and jumps became deeply stratified sites through repeated use" (1975:55). As well as attesting to the regularity of bison movements, more importantly the ethnohistoric record indicates that early human populations were aware of these regularities, allowing them to return repetitively to the same areas, an important survival factor for a pedestrian people.

The fact that pounds and jumps are deeply stratified sites brings into focus the contrast in depositional dynamics between different site types. Spatial constraints (corrals) are very concrete in kill sites such as pounds, the containment of the herds being essential for the success of the operation. Repetitive use results primarily in vertical deposition, explaining the deeply stratified nature of the archaeological materials. In campsites it is inferred that deposition tends to be horizontal, as individual residential bases are not generally reoccupied. Several of Kehoe's informants stated "...that it was not the usual practice for their people to return to the same ring" (1960:434). Therefore, from a temporal perspective, repetitive use manifested itself in cultural materials being distributed over a larger and larger area. In the Valley Complex the most important spatial constraints would be the slope walls. The archaeological remains would thus tend to spread along the valley bottom parallel to the stream edge. A cultural occupation level may occupy a large area on the horizontal plane but vertically be of limited extent. At the Garratt site (a winter campsite on the Moose Jaw River) the undisturbed Avonlea component in the soil profile ranged from approximately two inches (5 cm) to 6 inches (15 cm) (Morgan 1979:89). At the Long Creek site (Wettlaufer and Mayer-Oakes 1960) the undisturbed cultural levels ranged from less then one inch (2.5 cm) to about five inches (12.7 cm) in thickness. However, sites on the floodplains are often subjected to flooding, so that cultural debris from earlier years may be buried. In such cases new occupation levels may be established over the old ones.

On the basis of the above ecological and ethnohistorical data, it may be inferred that winter campsite areas should occupy large areas for several reasons: winter camps consisted of large numbers of people; the sites were used repetitively; and there was a tendency not to reoccupy precisely the same area during the following years. Since the annual occupation of a winter campsite was approximately seven months duration, artifact densities should be high and tool types highly diversified.

Artifact assemblages of winter campsites

Greiser (1985:46) has stressed that the most distinguishing characteristic of a long-term campsite is the variety of activities. Binford (1980:17) has coined the term "coarse-grained" to denote an archaeological assemblage accumulated over a prolonged period of time, resulting in the resolution between archaeological remains and specific events being poor. He also notes that as coarseness increases, the complexity and scale of assemblage content of any given uninterrupted occupation also increases.

Given the above, the winter camp site, calculated to have been occupied for up to seven months duration, should exhibit evidence for a wide variety of activities translating into a wide range of artifact types. The artifact classification system in Appendix III distinguishes the range of artifact types. Because of the lengthy occupation, artifact densities (particularly lithic debitage) on the winter campsite, as compared to other site types, should be the highest. Likewise FCR (Fire Cracked Rock) should exhibit its highest densities within this site type. Bone densities, with the exception of those in kill sites, would also be the highest on a winter camp site. Studies of surface assemblages by O'Brien and McDaniel (1982) led them to conclude that residential sites, as compared to procurement/processing sites, contain "... high artifact densities indicative of intensive and/or recurrent occupations..." (1982:250). They go on to state that the artifact assemblages at residential bases represent household activities such as tool manufacture and maintenance; food processing, cooking, and storage; and skinning and butchering (1982:232-234).

Greiser (1985:46) cites many of the above activities as relating to campsite functions; and in addition bone tool preparation, wood working, and social activities. She also lists some of the tools associated with manufacturing: hammerstones, antler tines, scrapers, gravers, etc. Also included are rejected preforms, broken tools, and manufacture debitage (1985:47).

O'Brien and McDaniel (1982:233-234) list three categories of debitage and/or the products of tool manufacture: (a) the by-products of initial lithic reduction classes which include cores, core rejuvenation flakes, core shatter, and primary and secondary decortication flakes; (b) tertiary flakes, the by-products of secondary lithic reduction and final products of manufacture; and (c) trimming - sharpening flakes which are indicative of tool maintenance. They also singled out small chipped stone tools as indicative of a residential base (1982:250). These include projectile points, bifaces, drills, and unifaces which indicate functions such as hide preparation, cambium stripping, and butchering. Other important artifacts that they associate with a residential base are ground stone and ceramics. Ceramics serve two major functions, cooking and storage. Ground stone tools have a variety of functions such as the preparation of plants for consumption (O'Brien and McDaniel 1982:234). Greiser (1985:47) also states that hearth areas and grinding stones are indicatives of food preparation activities.

More specifically, it is inferred that winter campsites, as compared to the other campsite categories, would exhibit the highest frequencies of ceramics. Stone boiling as a cooking technique would have been used more frequently during early occupancy of the site (in fall), but would become increasingly impractical as winter came and progressed. In winter, cooking food in earthen vessels or directly on coals would be the most common methods. Hearths thus had several functions: providing light, warmth, and heat for cooking processes. Lack of portability due to size and susceptibility to breakage suggested that ceramics would be left behind when the winter campsite was vacated. Frison (1967:39) also commented that earthenware pots are not easily transported without breakage, and are bulky items. Ceramics thus fall into what Binford (1979:263) defines as "site furniture" or items that "went with the place". Other items that fall into this category and could be considered as a combined diagnostic of a winter campsite include ground stone tools such as mauls and pestles and also anvils. With these latter tools, lack of portability is due primarily to their greater weight and some bulkiness.

Binford (1979:264) also lists hearth stones and hearths as site furniture. Defining hearth areas and/or stone boiling activities was impossible in my study area since the field survey was mostly carried out on disturbed surfaces. Since the fire-cracked rocks were scattered, and no longer in situ, there was no way to discern whether the fragments were from hearths and the result of only heat fracture; or whether they were the products of stone boiling. Since FCR was generally ubiquitous throughout the study area and associated with almost all site types, it was not considered diagnostic. However, hearths must be present on a winter campsite, considering the need for heat during adverse weather conditions.

From a broad perspective I find no argument with the above suggested tool inventories in defining a winter campsite. There is, however, an important omission that would be particularly definitive of a winter campsite; i.e., large butchering tools. It is inferred that during the winter most secondary butchering and possibly some primary butchering would be carried out at the residential base because of unfavorable weather conditions. Briefly, winter brings about the conditions, i.e., accessibility to the herds, for carrying out hunting operations, communal or otherwise. Inclement weather forced the herds to abandon the open plains and seek shelter in wooded areas and/or valley bottoms where winter campsites are also found. Peter Fidler at Buckingham House on the North Saskatchewan on December 20th, 1796, observed that:

> We are but middlingly off for provisions, having only three weeks stock before hand, but hope the buffalo will be soon nearer us than before by reason of the severe weather that has of late prevailed (in Johnson 1967:79).

The winter of 1799-1800 was particularly difficult, as mild winter conditions continued for a considerable period. Food scarcities were acute for both traders and Indians. Bird, at Edmonton House on February 24th, 1800, observed that:

> The two parties [Blackfeet] brought us 494 made beaver in wolves and small foxes but no provisions of any kind; indeed they complain of not being able to procure sufficient provision for their own families, there being a scarcity of buffalo everywhere owing principally to the amazing warmness of the winter (in Johnson 1967:235).

Henry's observations on January 1 - 2, 1801, on the Red River corroborate the correlation between severe cold and abundant bison, but also the difficulties of butchering under these conditions:

> I soon came near the buffaloes, and found an Indian who had killed a cow, and was cutting her up. But the cold was so intense that it obliged him to give it up and return to his tent. I fired many shots, but killed only three; it was impossible to cut them up. I contented myself with raising the fat and tongues, and returned at dusk with a heavy load on my back (in Coues 1965:163).

More specifically, McGillivray's observations during a visit (November 24, 1794) to a Piegan winter campsite to witness the operation of a pound, provided evidence that not only was meat processing being carried out at the camps but that the kill site was located close by (in Morton 1929:43). There also appeared to be a high tolerance for the odoriferous conditions generated by the above proximity of the kill site. He commented:

> It proceeded from the Carcasses in the Pound and the mangled limbs of Buffaloes scattered among the Lodges, but another substance which shall be nameless contributed the most considerable part of this diabolical odour (in Morton 1929:43).

The definitional attributes of one of Binford's (1979) categories - "personal gear" - provide important insights into the operational aspects of a winter campsite tool kit. He notes that personal gear is generally manufactured "...according to quality considerations unaffected by constraints on time or immediate availability of appropriate material, since this activity is intended to meet anticipated future needs, rather than immediate needs" (1979:267). This gear includes a vast array of items and/or tools such as bone cutters, cores, axes, bow, arrows, knives, etc. In the previously defined winter camp lithic assemblage, personal gear would correlate most strongly with the small chipped stone tool category. Personal gear is "curated"; that is, it is heavily recycled and reused. Also discarding, maintenance, and manufacturing of personal gear tends to occur at a residential base. An important aspect of the manufacturing process is that it is carried out in a staged manner; certain modifications would be made, then items would be stored for a time before the next stage of modification (Binford 1979:268).

Consideration of the above suggests that pressure flakes, debitage resulting from the final stages of both manufacture and maintenance, would have a high frequency representation on a winter campsite. Perhaps of greater importance and even more diagnostic would be the presence of tools in different stages of manufacture. This characteristic has its highest visibility in the projectile point type category (see Appendix III for descriptions). Therefore, a high frequency of unnotched projectiles should be found on a winter campsite.

Personal gear is generally constructed from higher quality raw materials. In the Plains bison hunting tradition Knife River Flint, a trade item from North Dakota quarries, is a much desired high quality material used when available in the manufacture of small chipped stone tools. Therefore a winter campsite should exhibit the highest frequency of Knife River Flint debitage; i.e., core fragments, shatter flakes, pressure flakes, etc.

At the Garratt site (Morgan 1979) tools in the Chipped Stone Industry in level six (Avonlea) were primarily constructed from chert (42.2%) and Knife River Flint (32.2%). Although chert is a high quality material it is mostly local and generally ubiquitous in distribution, and does not appear to be diagnostic for any particular site type.

Bone tools are also an important component of a winter tool kit. Because only surface collections were available for these analyses, these artifact types, because of susceptibility to weathering when exposed, were not present with one exception, i.e., a flesher.

Faunal assemblages at winter campsites

Given the above ecological conditions, butchering in winter at the kill site would be minimal. Since time was of the essence, the major objective would be partitioning of the carcass into portions small enough to make them portable to the residential base. This procedure basically entailed quartering the animal and separating the meat from the axial skeleton. The above preliminary butchering technique were briefly described by one of John Ewer's informants [Blood].

> In butchering the bison, the man'o was sliced off, alongside the boss ribs. Man'o is a 'roast'. Then the carcass was quartered, the front legs taken off with the shoulder blade and the hind legs cut at the femur - pelvis joint (in Kehoe 1967:70).

Faunal remains from the Garratt site (a winter campsite) reflect the above butchering processes (Morgan 1979:93-95). There were two levels that had a sufficient sample for comparative analysis: (a) Level 1-2: Plains/Prairie component - 8 animals; and Level 6: Avonlea - 12 animals. In both levels the relatively high representation (based on the minimum number of individuals, MNI) of scapula remains (Level 1-2 - 62.5%; Level 6 - 50.0%) indicates that it was frequently removed with the foreleg in the initial butchering stages at the kill site. The almost total absence of pelvis remains suggests that the hind leg was separated at the joint and the pelvis left at the kill site. With the exception of the mandibles, bison axial portions were limited in number, indicating they were also left at the kill site. The most significant aspect of the Garratt site faunal remains is the high frequency of lower limb elements, suggesting that both fore and hind limbs were moved in their entirety to the residential base. Phalanges ranged from 62 to 75% representation on level 1-2, while in the Avonlea levels representation ranged from 91.6% to 100%. In regards to the forelimb, some carpal elements (lunate) ranged as high as 100% representation on both levels. Metacarpals reached a high of 50% at both levels. The lower portions of the hind limb also have a relatively high representation. Some tarsal elements such as astragalus reached 75% on level 1-2 and 50% on level 6. Metatarsals had a high of 50% on level 1-2 and 41.6% on level 6. Femur elements were extremely low in representation; however, there is agreement among investigators that these bones are often not recognizable because of extensive fragmentation during marrow extraction (Kehoe 1967:72; Quigg 1974:153).

The faunal remains from the winter campsites in the Belly River Valley of southern Alberta (Quigg 1974) broadly exhibit some of the above trends. The site excavation levels (Table 9:52) with bison representation greater than three bison numbered eight, and will be those referred to in the analysis. Percentages are based on MNI.

With the exception of one level (DnPj-31-Old Woman's), in which lumbar vertebrae had a frequency of 80%, vertebrae had a generally low representation, indicating their abandonment at the kill site. Mandibles had a high representation in only two levels; Avonlea (49%) and Old Woman's (72%) at site DnPj-31. Lower leg portions had a high representation, particularly for the rear limbs. In seven out of eight levels at least one metatarsal frequency (proximal or distal) was greater then 50%, ranging up to 80%. Astragalus had a 100% representation in three levels. Lower forelimb portions also had a reasonably high frequency. Metacarpals, in six out of eight levels, had at least one frequency (proximal or distal) ranging from 40 to 91%. In four out of eight levels at least one carpal element had a frequency ranging from 42 to 100%. In four out of eight levels at least one phalange type (1 to 3) had a frequency ranging from 48% to 88%.

The above suggested trend and/or frequency relationships for the osteological remains on winter campsites would not be consistently generated if the duration of stay, from fall to spring, is considered. During the fall, under more temperate conditions, butchering would be more extensive at the kill site, affecting to some degree the overall frequency distribution of faunal remains, particularly limb elements.

Spring Campsite

One of the most definitive attributes of this site type is its location. It is most often located on the adjacent uplands of the Valley Complex, and sometimes on an elevated area that gives an unobstructed view not only of the valley but the surrounding plains. Although excessive moisture conditions in spring on the valley bottoms initiated movements out the Valley Complex (Kehoe 1960:433), the choice of elevated areas was equally important for monitoring bison herd movements. By this time the herds had also abandoned the sheltered areas, lured by the emergence of the earlier growth of spring grasses on the exposed uplands and upper southern exposure slopes areas (Morgan 1980:151). In addition, the herds were becoming mobile; and initial movements to the summer range were beginning. Other less frequent locations for this site type are on upper slope areas, or the site may spread across several elevations including the uplands and upper slope areas. Nearby, in the Valley Complex, should be the associated wintering area and kill site.

As to length of stay, I previously noted that the evacuation of the winter campsites correlated with the initiation of spring runoff, which occurs most frequently about mid-March. This in turn signaled the beginning of occupancy of the spring residential base. In my previous research it was also concluded that the movements of the bison herds to the summer range peaked sometime in early May (1980:152). This move would provide the impetus for similar human population movements, which should have occurred shortly after (Morgan 1979:176). Therefore the maximum length of stay on a spring residential base would have been from around mid-March to mid-May, a duration of approximately two months. Repetitive use, however, implies that this site type would also occupy a large area.

Most spring campsites are also tipi ring sites. Holding down tents with rocks would be particularly essential during this time of the year; not only are the spring campsites in more exposed locales, but wind velocities are greater. Longley (1972) notes that in the prairies, "Well-organized storms with deep low pressures are more frequent during the spring and fall so that the mean winds have maxima in April or May and again in October" (1972:67).

Unfortunately, in the study area all upland areas were cultivated, so that it was impossible to determine if the spring sites were associated with tipi rings. Because these were spring campsites, and weather conditions were more temperate, a large percentage of activities should have occurred outside the tipi rings. However, inclement weather also occurs sporadically; so that features such as hearths and evidence of cooking should also occur within rings as well as outside.

Some of the Alkali Creek tipi ring sites in Alberta (Adams 1978) exhibit several attributes that would place them in the spring campsite category, and support the above assumptions. More specifically, EfOp-324 is an eight ring tipi ring site located on a narrow bluff overlooking the valley of Alkali Creek, a tributary of the Red Deer River. The general location of the sites places them in an area historically defined as a wintering area. Fidler, who established Chesterfield House at the junction of the Red Deer River and the South Saskatchewan, observed several groups, (Fall [Gros Ventre], Blackfeet, and Blood) wintering in the area (in Johnson 1967). More specifically he noted on January 4, 1801, that the Fall Indians were coming to trade from a pound 20 miles away (in Johnson 1967:281). On November 27, 1801, he also observed (p.302) that the Blackfeet were making a pound not six miles from the trading house. Then, as early as April 3, 1802, Fidler (p.320) noted that he had seen the last of the Blackfeet; and finally on April 16 he (p.321) concluded that the bison are scarce and "...no more Indians are now expected here by the lateness of the season".

Adams (1978:48) infers that EfOp-324, because of the exposed location, is a summer camp. The ethnohistoric record, however, indicates that by mid-spring the area had been abandoned, as the various groups followed the bison herds out onto the summer range. The archaeological remains also support the inference of both favorable and unfavorable weather during the time of occupancy. The presence of interior hearths in the four excavated rings suggests the need for warmth as well as cooking during inclement conditions. However, the presence of two hearths outside the rings, as well as the fact that higher frequencies of both lithic tools and debitage were also found outside the rings (Adams 1978:41-42), signals more temperate conditions.

During these two months activities would tend to focus on preparations for movements to the summer range. I had inferred previously that during major movements (to the summer range and back) there would be a heavy reliance on dried provisions; therefore provisioning would be a major activity (Morgan 1979:183). It would appear that provisioning during this time period, particularly with the herds becoming mobile and scattered across the open prairies, would be a difficult undertaking; but as I also previously mentioned, the use of fire could concentrate the herds in specific areas for a continuation of communal hunting practices (Morgan 1979:182)

There is also one other possibility. During winter, because of mostly below-freezing conditions, waste is almost negligible. A stockpiling of bison resources which have undergone primary butchering processes could be easily accomplished. Milder spring weather would provide the impetus for a period of high intensity conversion of these resources to the dry provisions essential for the spring migrations. There is little evidence in the archaeological record to support the above; however, Frison (1967:5) did suggest that an arrangement of stone piles with a post mold in one pile at 48 JO 311, a tipi ring site, may be the remains of a scaffold structure. A structure of this nature could have been used for meat drying. Other important activities would have included, as previously mentioned, the preparation and cooking of food. In addition, maintenance and recycling of personal gear would have also been important. Manufacture of new tools would have been at a minimum, as major movements entail an abandonment of many tool types rather than the construction of more.

The artifact assemblage

Because duration of stay was significantly shorter, overall artifact densities as compared to the winter camp would be significantly lower. Because of the short duration of occupancy and the prospect of major movements to the summer range, lithic debitage should mainly reflect maintenance and/or repair of tools rather than new manufacture. In other words, primary lithic reduction debris such as cores, core fragments, and shatter flakes should be in low frequencies. The range and number of tool types should also be high for much the same reasons: (a) the need for abandonment of many bulkier elements, to facilitate major movements; and (b) a need to discard exhausted tools, many of which were a carryover from the winter tool kit. Because of the fact that a significant proportion of the lithic tool assemblage may be a carryover from the winter campsite, it would be difficult to identify positively which tools actually reflect site function.

There are some broad frequency patterns that may be somewhat site-specific. Site furniture, i.e., mauls, anvils, ceramics, and pestles, diagnostic for winter camps should be absent or in small frequencies. However, if provisions are being prepared, some large tools, i.e., mauls or hammerstones, may be present for pounding dried meat. Tubular bifaces and unifaces (see Appendix III for descriptions) should also be present, being needed to construct hide bags for pemmican. Small frequencies of ceramics may actually be considered as diagnostic, a carryover from a nearby winter camp. Large core tools, as would be used in primary butchering, should be mainly absent.

Among the Piney Creek sites (Frison 1967), site 48 JO 311 again provides some supportive data for the above inferences. Briefly, the Piney Creek sites are located in a broad transition zone in the foothills of the Big Horn Mountains. The general area supports abundant and varied fauna, and stream valleys are numerous. The area appears ideally suited for winter habitation by prehistoric human populations. The above site consists of 20 tipi rings, and is located on an exposed terrace between the confluence of Piney Creek and a dry tributary. All rings were excavated except those deflated of soil, which numbered seven. In close proximity in the valley bottoms is a kill site; and approximately 300 feet away is an area Frison (1967:12) defines as a butchering/processing site (48 JO 312). The area (which appears to extend farther into a hay field) exhibits many of the features of a winter campsite. As previously stated, butchering and processing of faunal resources were important functions in a wintering area. Also, the presence of hearths, some boiling pits, large frequencies of ceramics (1,677 sherds), possible pottery manufacturing areas, a large variety of lithic tool types, bone tools, grooved mauls, etc., all point to a winter camp artifact assemblage.

At the tipi ring site, areas outside the rings were not excavated, so that artifact densities could not be compared between interior and exterior areas. However, central hearths were present in nine of the stone circles, implying some inclement weather during occupations. An important observation by Frison (1967:7) that provides support for the suggested site type designation is that lithic debitage reflects resharpening rather then manufacturing processes. Ceramics (245 sherds) have a low frequency, reflecting a carryover of a few vessels from the wintering area. Projectile points (26), of which five are unnotched and ten are fragments (Frison 1967:67), reflect the final stages of manufacture, maintenance processes, and discarding. Other lithic tools include endscrapers, drills, bifaces, and retouched flakes. The presence of a maul and two hammerstones lends some credence to the preparation of dry provisions as an activity. However, these tools are multipurpose and can be used for a wide range of activities.

Another possible site attribute is that, compared to a wintering area, FCR exhibit much lower frequencies owing to a shorter period of occupation. Bone materials are problematic, being highly susceptible to deterioration on exposed areas so that accurate comparisons would be difficult.

Frison has postulated that 48 JO 311 (the tipi ring site) was the campsite for the bison drive operation which occurred in fall. However, he did note that the site's exposed nature argued against a winter occupation and that strong winds attacked the site almost daily (1967:26). In other words, the site was highly susceptible to inclement weather during most of the year. Given the above, why would a fall campsite be established on the prairie uplands when the valley interior provides the ideal habitat conditions? From an ecological perspective sheltered conditions, as well as essential resources such as water (particularly in fall) and wood are strategically clustered in the valley bottoms and/or lower slopes; so also are the products of the bison drive operations. From another perspective one should also consider the vast amount of energy that would be exerted and wasted in moving these resources to the uplands. Again, it is postulated that the site was occupied in spring because factors more important than, for example, susceptibility to high winds, became operative. As previously stated, in spring the valley bottoms became uninhabitable because of excessive moisture conditions; the bison had scattered into the open prairies; water resources were not a limiting factor; and the need to monitor herds and possibly the movements of other human groups required an exposed site.

What is being described here is the initial spring campsite on the winter range. As the group moved toward the summer range and stops were made at water sources (e.g. tributaries, lakes, depressions, etc.), secondary spring campsites were generated. These would have been occupied for a shorter period; therefore relatively fewer archaeological remains would be present.

Summer Campsite

This site type is out of the scope of this study. However, several broad attributes are proposed. I previously suggested that through the use of fire and non-disruptive hunting techniques, bison herds could be maintained on the summer range in select areas, specifically those geographically suited for pounding activities and associated with adequate water resources (Morgan 1979:177). As a result, during summer human populations could lead a relatively sedentary life style. Occupancy of the summer range by human populations was estimated at about 3 1/2 months (Morgan 1979:182). Site locations would also be near Valley Complex systems. High humidity, insect pests, and in this case, shelter as a detrimental effect, i.e., reducing the effects of cooling winds, would act against occupation of the floodplains. Locating on middle to upper slopes would allow summer breezes to modify most of the above effects, while access to water resources would still reasonable. Kill and butchering areas would be an appreciable distance from the residential base because of the effects of spoilage.

Kill Sites

Bison Drives

Two types of hunting techniques are found within this category: jumps and pounds. The geographic distribution of these hunting techniques is uneven. Jumps are found most frequently along the Rocky Mountains, while pounds are more common on the level plains (Arthur 1975:72).

Forbis (1962:64) describes the differences between a pound and a jump. A pound was an enclosure into which bison were driven. The pound was bounded on one side by an escarpment, frequently along a creek; and on the other three sides by a wooden fence. A jump is a steep cliff or steep slope over which bison were driven. Forbis (1978:5-6) also notes that artificial fences were often built to guide the animals to the kill area. These fences were constructed from a range of materials: turf, stone, dung, or brush.

In the study area the drives are mainly pounds. A winter pound would tend to be in close proximity to the winter camp. Frequent inclement weather would make easy accessibility an important consideration. These same climatic conditions make it possible to remain in close proximity without any odorous consequences.

In the site type classification of the winter campsite, length of stay was estimated at approximately seven months. It was also concluded that drives were operated all winter long. Compared to a summer kill site, there would be a greater accumulation of cultural remains at a winter kill site. The area occupied by the winter kill site would also be of greater extent. Skinner notes for the Plains Cree:

> Sometimes when the people were camping by a pound all winter, they found it too small for their needs, and were obliged to enlarge it by piling up the buffalo meat already dried or frozen to make new pounds (1914b:525-526).

Surround

Historical documentation by Arthur (1975:64-67) indicates that this hunting method could be carried out by a wide range of techniques: setting up lodges around the herds; women setting up travois in a semi-circle; using fire to surround the herds; and mounted hunters surrounding the herds. In the study area the serpentine nature of the waterway form cul-de-sacs- a natural surround - into which bison herds could be driven and killed.

These areas have high frequencies of bone material and some FCR. Lithic materials are scarce, consisting primarily of large flakes and shatter.

Special Purpose Sites

Observation Post

This site type is used basically for collecting information on game presence or movements (Binford 1980:12). Although hunting stands (Binford 1978) are not a site type that would be generated by Plains bison hunters, some of the attributes defining the site type would be applicable to a Plains observation post. Binford notes that the location of the site is chosen to provide "...maximum visual coverage for a large area..." (1978:330). He also states that activities occurring at these sites are mostly related to reducing boredom (1978:331). In other words, watching game does not itself generate archaeological evidence. More specifically, Binford observed that at the Mask site (a Nunamiut Eskimo hunting stand), archaeological remains primarily reflected eating, playing games, and crafts activities (1978:335). He also notes that these sites were rarely occupied overnight (1978:330).

In the Plains Valley Complex systems, some of these sites would be found on the uplands close to the valley rim to provide a good view of the valley, and occasionally the surrounding prairie. They would also be located near the main residential base in the valley bottoms. These sites would be used mainly in fall and early winter, after the groups have returned from the summer range and settled into their wintering areas.

The main function of this site type was to monitor the movements and behavior patterns of a range of herbivores; e.g., bison, deer, elk, etc. Treed areas in the valley are not abundant, and also concentrated in specific areas such as northern exposure slopes and associated floodplains. Faunal forms such as deer and elk (alternate food sources) would be attracted to these areas. Again, because treed areas are not abundant the movements of these animals could be easily seen and monitored from the observation posts. Likewise, mammals is 15. Of these, snowshoe hare is represented by six, hare/rabbit by two; and the rest - bison, wolf, fox, dog/coyote, beaver, river otter, and human - are each represented by one individual (1986:234). Fish are represented by a total of 10 individuals (MNI) of which eight are spring spawners; the remaining are fall spawners (1986:236).

A major diagnostic in this site type is the association with a lake environment; and the high frequency of fish remains in the faunal assemblage, as compared to bison which is poorly represented. According to Smith (1986), the historical record indicates that most fishing in the Parklands occurred along rivers at confluences, and at the river mouths at lake entrances. Also fishing appears highly seasonal, mainly in spring after ice breakup, when spawning runs occur (Smith 1986:295-96). The lithic assemblage reflects the above faunal composition to some extent. The Cobble Stone Industry is poorly represented; that is, the large cobblestone tools (spalls, cores) associated with butchering are not present. The extremely high frequency of secondary reduction flakes suggests that maintenance and repair may be more important activities than new tool construction, possibly in anticipation of following the herds to the summer range. The presence of ceramics may indicate a carryover from the wintering areas.

Cairn

My previous research (1982) led me to suggest that one function of cairns on the winter range may represent stockpiling of lithic materials (cobble stones) for winter tool construction. Although my field work in the study area has not located this site type, such sites are usually found on exposed elevated areas, contain few artifacts, and often have subsurface hollows filled with gravel (Adams 1978:64). I have suggested that cairns are generally placed on elevated areas allowing for accessibility, as snows do not accumulate on these areas in winter. A gravel base prevents moisture accumulation, which in turn prevents stones from adhering to the ground when it freezes. A minimal artifact recovery implies that cobbles were removed to the shelter of the winter camps before tool construction occurred. In spring cairns were a source of tipi ring stones.

SURVEY: RESULTS AND DISCUSSION

Cottonwood Creek (Fig. 13)

During the archaeological survey one of the initial observations was the ubiquitous distribution of bone along the floodplains and lower terraces of Cottonwood Creek. A site designation, therefore, entailed a combination of this material with at least one or two other types of cultural materials, which commonly was FCR (Fire Cracked Rock). Detailed descriptions of the sites, and artifact tables are found in Appendix II; while descriptions of artifact types are in Appendix III.

On the basis of the attributes listed for the various site types, the 15 sites surveyed along Cottonwood Creek were categorized as follows:

Inferred Temporary Campsites

(a) Frequent Use

1. Confluence EdNf-21
2. Young I EdNf-26
3. Young II EdNf-27
4. Volke I EdNf-19

(b) Infrequent Use

1. Lax I EdNf-23
2. Lax II EdNf-24
3. Lax III EdNf-25
4. Volke II EdNf-20
5. Old Well EdNf-28
6. Thompson I EdNf-31

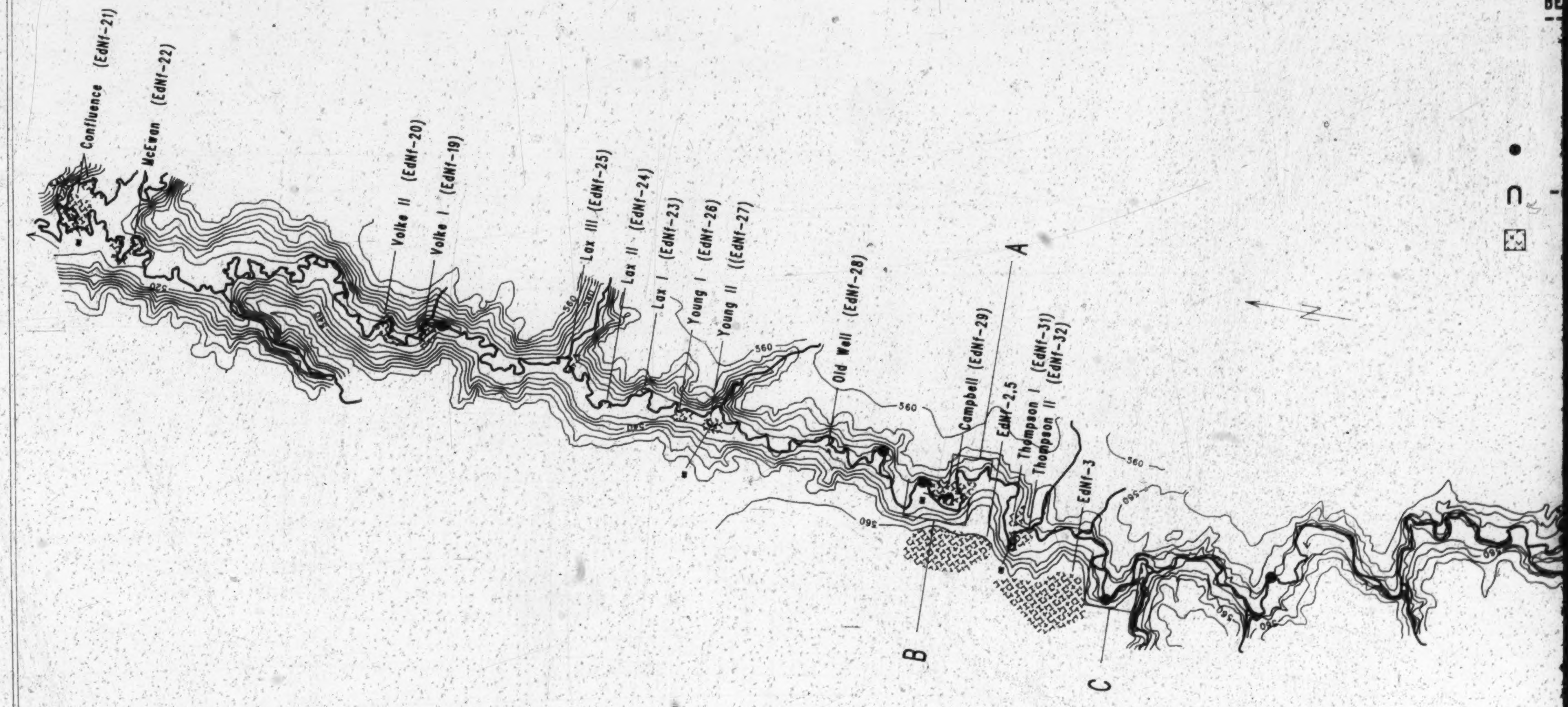
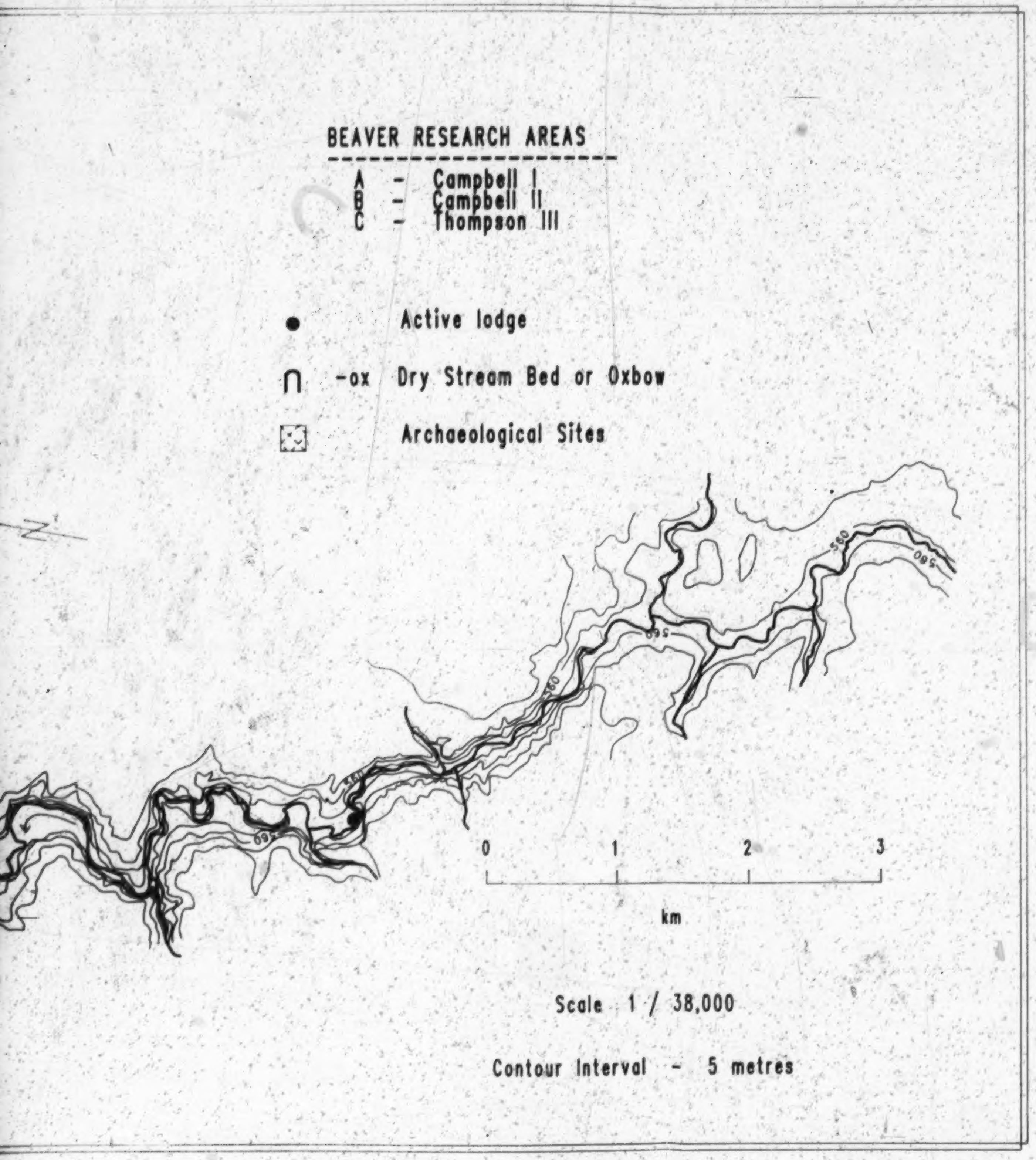

Confluence (EdNf-21)
McEwan (EdNf-22)
Volke II (EdNf-20)
Volke I (EdNf-19)
Lax III (EdNf-25)
Lax II (EdNf-24)
Lax I (EdNf-23)
Young I (EdNf-26)
Young II (EdNf-27)
Old Well (EdNf-28)
Campbell (EdNf-29)
EdNf-2,5
Thompson I (EdNf-31)
Thompson II (EdNf-32)
EdNf-3
A
B
C
N
560
BE

Figure 13 Cottonwood Creek archaeological sites and beaver research areas


BEAVER RESEARCH AREAS
A - Campbell I
B - Campbell II
C - Thompson III
● Active lodge
∩ -ox Dry Stream Bed or Oxbow
▨ Archaeological Sites
560
0
1
2
3
km
Scale 1 / 38,000
Contour Interval - 5 metres

Inferred Winter Campsite

1. Thompson II EdNf-32
2. Campbell EdNf-29

Inferred Spring campsites

1. EdNf-3
2. EdNf-2,5, considered to be one site

Inferred Surround

1. McEwen EdNf-22

The temporary campsite category represents 10 or 66.6% of the sites on Cottonwood Creek, followed by the spring campsite type, with two or 13.3% of the sample. Two winter campsites (13.3%) and one surround (6.6%) complete the site frequency pattern.

Inferred Temporary Campsites

All of the temporary campsites, which were found on the floodplains, tended to be located in open conditions; and when artifact concentrations were observed they were generally proximate to the stream edge. The exception was Volke I, which has artifact clusterings along a northwest-facing slope; i.e., under sheltered conditions.

In the artifact assemblages, several broad patterns were discerned for both frequent and infrequent types (Table 10, Appendix II). In the General Debitage category, flakes and shatter were found at all sites; however, pressure/retouch flakes were absent from all sites. In the Chipped Stone Tool Category no representative tools were recovered in the infrequently-used sites. In the frequently-used sites, the number of tool types ranged from 0 to 2; and were mostly unifaces. In the Cobble Stone Industry spalls were the most common tool. For all sites there is a basic artifact assemblage consisting of bone, FCR, several flakes and/or shatter (mostly chert), and at least one Cobble spall.

The minor differences between the two site types represents temporal rather than activity variations. On frequently-used sites accumulations would occur. As a result, the General Debitage category would have higher frequencies. Through time, several Chipped Stone tool types would also be deposited because of occasional use. The Cobble Stone Industry particularly would have more representation, as spalls would be needed each time the site was occupied, for lithic reduction and/or food preparation - activities specifically associated with the temporary campsite. In fact, the Cobble Stone Industry is the most important industry in this site type.

Inferred Winter Campsites

The site designation of winter camp relied heavily on ecological characteristics, as artifact materials, particularly at the Campbell site, were too few for many diagnostic features to be discerned. Both the Campbell (EdNf-29) and Thompson II (EdNf-32) sites (Fig. 13) exhibited the ecological conditions put forth as ideal for winter habitation. Both sites are associated with treed, northeast-facing slopes and a waterway in close proximity.

A supportive characteristic was the close proximity of two large spring campsites on the uplands. Spring campsite EdNf-3 is a short distance upstream from the Thompson II winter camp, and directly above the Thompson III beaver-occupied area. Spring campsite EdNf-2, 5 is directly above the Campbell site.

At Thompson II, artifact concentrations were greatest on the first terrace along the slope edge, where shelter conditions would have been available. In the artifact assemblages (Table 6) three point types were identified: the Plains/Prairie, Avonlea, and Besant. These types are associated with the Late Plains Indian period, dating 2000 B.P. to 170 B.P. (Dyck 1983). The General Debitage category had a sufficient amount of initial lithic reduction debitage, such as shatter and core fragments, to suggest that tool manufacture was an important activity. Chert was the most common lithic raw material.

Several characteristics indicative of winter occupation were noted. The range of Chipped Stone Tool types (7) was much greater then that demonstrated at the temporary sites. The presence of a Tubular Uniface (incisor) hints at winter campsite activities. The absence of ceramics, however, is a negative attribute in terms of a winter site designation. A positive attribute is the possible presence of a kill site in the vicinity.

At the Campbell site artifact materials extend from a disturbed homestead yard across the creek to an undisturbed native grasslands area which ends at another loop in the stream, a distance of about 0.6 km - an extent expected for a wintering area. In the undisturbed area, rodent activities indicate that densities of cultural materials, mostly bone, FCR, and General Debitage, are substantial and continual. The one diagnostic winter campsite artifact, a pestle, was found in the undisturbed area. It is particularly diagnostic, being part of the winter tool kit designated as "site furniture", which are artifacts which remain on-site when a group moves to other areas.

Inferred Spring Campsites

Two sites were distinguished as spring campsites (Fig. 13). The most definitive attribute was their location on the exposed uplands of Cottonwood Creek. The locations gave a strategic view of the tributary; and in the case of EdNf-2,5, which was slightly elevated, a reasonably good view of the surrounding prairies. Another distinguishing factor was their large size, up to 0.8 km^2, indicating repetitive use over an extended period of time.

As previously noted, what is particularly significant is that both spring campsites were in proximity to the only sites designated as wintering areas in the tributary. Both of the winter sites are located on the west side of the tributary in association with a treed northeast-facing slope. The location of the spring campsites on the west side of the creek is highly appropriate. It would be possible to move directly to the summer range without the hardships of crossing a tributary during high water.

Supporting archaeological evidence, however, was elusive. It was inferred that spring campsites are usually tipi ring sites with associated diagnostic features. Unfortunately these sites have been completely disturbed by cultivation, and subsequently reseeded to pasture. Most evidence therefore is obscured. Inferences are thus restricted to several surface artifact collections with no spatial control. However, both EdNf-3 and 5 were large collections (Table 8 and 9); so that some characteristics could be discerned that support their designation as spring campsites.

The diagnostics suggest a very broad time span of occupation, from the Early Plains Indian period to the Historic period (10,500 B.P. to 100 B.P.) (Dyck 1983). The point types with the greatest representation are the Plains/Prairie and Besant, both from the Late Plains Indian period (2000 B.P. to 170 B.P).

It was suggested that debitage components such as cores and shatter should be limited because maintenance, rather than construction of new tools, would be the primary function. On all sites, flakes and fragments generally dominated the General Debitage category. A large sample of cores was found only in the EdNf-5 artifact assemblage. Some other suggested site attributes were more easily discerned. Site furniture as recognized for a winter campsite, i.e., anvils, mauls, and pestles, were absent. Small frequencies of ceramics were recovered from the sites, implying a carryover from a nearby winter campsite. Large cobble core tools, as would be associated with primary butchering, were absent. This absence may reflect the bias of the private collectors, being inferior collectors' items.

Almost the complete range of tool types in the Chipped Stone Tool Industry were represented at these sites. On a site type with occupancy suggested to be, at most, of two months' duration, this variety implies a carryover of a winter tool kit from a nearby wintering area. The fact that many of these tools are either fragmented or incomplete, and in addition mainly exhibit pronounced wear patterns, points to the discarding of exhausted tools.

The pattern of raw materials use was consistent on all sites. Chert was the most frequently used material in most categories, followed by Silicified Peat, a local type of layered brown chalcedony; then KRF (Knife River Flint), which is an important trade material from the quarries in North Dakota. The recovery of a few flakes of obsidian also suggest trade patterns to the southwest.

Inferred Surround

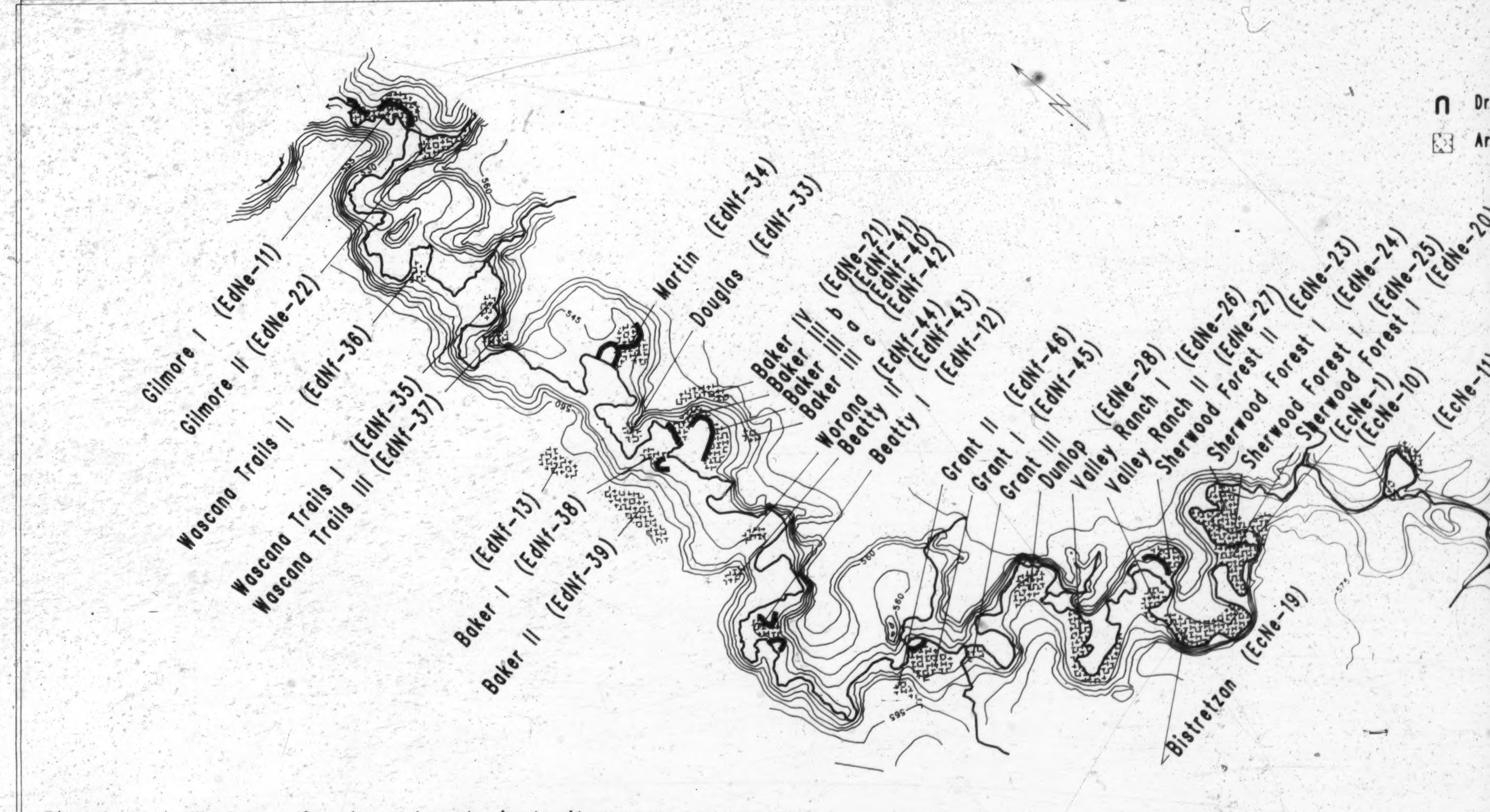
One site (EdNf-22) was found on the floodplain at a point where the waterway formed a cul-de-sac. FCR and bone were the most abundant cultural materials. Lithic materials were restricted to shatter.

Wascana Creek (Fig. 14)

Overall artifact densities on Wascana Creek are significantly greater than on Cottonwood Creek. Underlying the specific site concentrations of artifacts is a level of low-density cultural materials, which have a ubiquitous distribution along the valley bottom. These cultural materials consist primarily of bone, and to a lesser extent lithic debris such as shatter flakes and blocks. It was difficult to discern the low-visibility site type, infrequently-used temporary campsite. Site type classification on Wascana Creek was restricted to the broader category of temporary campsite. Detailed descriptions of the individual sites are in Appendix II. On the basis of the attributes listed for the various site types, the 27 sites surveyed along Wascana Creek (Fig. 14) were categorized as follows:

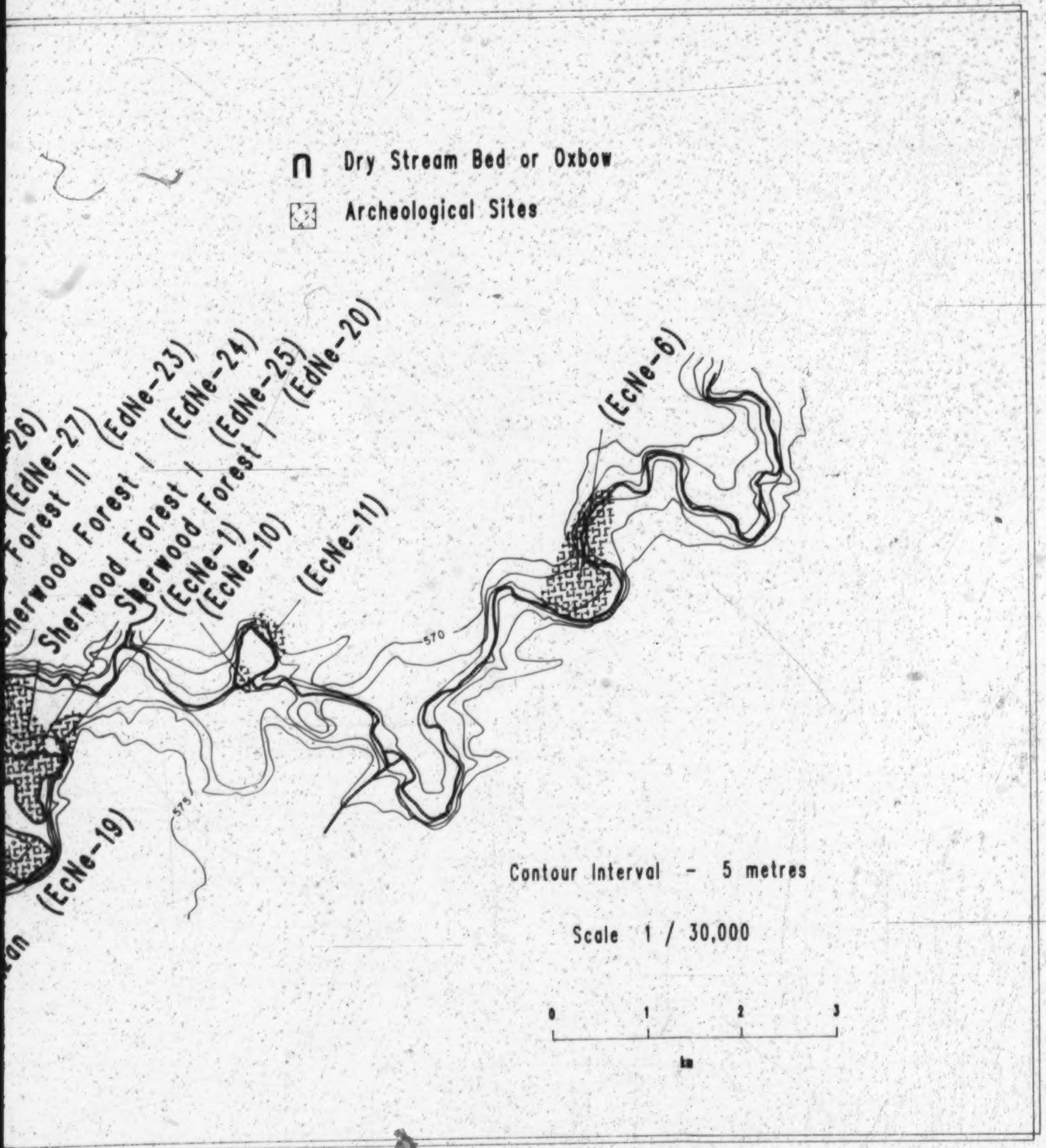
Inferred Temporary Campsites

1. EcNe-10
2. Valley Ranch II EdNe-27
3. Grant III
4. Worona EdNf-44



Gilmore I (EdNe-11)
Gilmore II (EdNe-22)
Wascana Trails II (EdNf-36)
Wascana Trails I (EdNf-35)
Wascana Trails III (EdNf-37)
Martin (EdNf-34)
Douglas (EdNf-33)
Baker IV (EdNe-21)
Baker III b (EdNf-41)
Baker III a (EdNf-40)
Baker III c (EdNf-42)
Worona (EdNf-44)
Beatty II (EdNf-43)
Beatty I (EdNf-12)
(EdNf-13)
Baker I (EdNf-38)
Baker II (EdNf-39)
Grant II (EdNf-46)
Grant I (EdNf-45)
Grant III
Dunlop (EdNe-28)
Valley Ranch I (EdNe-26)
Valley Ranch II (EdNe-27)
Sherwood Forest II (EdNe-23)
Sherwood Forest I (EdNe-24)
Sherwood Forest I (EdNe-25)
Sherwood Forest I (EdNe-20
(EcNe-1)
(EcNe-10)
(EcNe-11
Bistretzan (EcNe-19)
555
570
560
545
560
560
560
565
575
N
Dr
Ar

Figure 14:- Wascana Creek archaeological sites


ᑎ Dry Stream Bed or Oxbow
▨ Archeological Sites
26)
(EdNe-27)
Forest II (EdNe-23)
herwood Forest I (EdNe-24)
Sherwood Forest I (EdNe-25)
Sherwood Forest I (EdNe-20)
(EcNe-1)
(EcNe-10)
(EcNe-11)
(EcNe-6)
an (EcNe-19)
570
575
Contour Interval - 5 metres
Scale 1 / 30,000
0
1
2
3
km

5. Wascana Trails I EdNf-35

Inferred Observation Post

1. EcNe-11
2. Grant II EdNf-46
3. Beatty II EdNf-43
4. Baker IV EdNe-21
5. Wascana Trails III EdNf-37

Inferred Winter Campsite

1. EcNe-6
2. Sherwood Forest I sites
    EdNe-20
    EdNe-24
    EdNe-25
3. Sherwood Forest II EdNe-26
4. Bistretzan EcNe-19
5. Valley Ranch I EdNe-26
6. Dunlop EdNe-28
7. Grant I EdNf-45
8. Beatty I EdNf-12
9. Baker I EdNf-38
10. Baker III sites
    a) EdNf-40
    b) EdNf-41
    c) EdNf-42 (kill site)
11. Martin EdNf-34

12. Gilmore II EdNe-22
13. Gilmore I EdNe-11

Inferred Spring Campsite

1. Baker II (EdNf-39 and EdNf-13 are considered one site)

Non-designated Sites

1. Wascana Trails II EdNf-36
2. EcNe-1
3. Douglas EdNf-33

Inferred Temporary Campsites

The five sites in this category have a more varied position in the valley than was found in Cottonwood Creek. Only two sites (EcNe-10; EdNf-35) are located on the floodplain. One site (EdNf-44) is found along a sheltered slope wall; another (Grant III) is on a terrace; while the remaining one (EdNf-27) extends midway up a slope. Four of these sites are associated with open conditions.

The artifact assemblages exhibit much the same patterns as were observed for the frequently-used temporary campsites on Cottonwood Creek (Table 35, Appendix II). The Chipped Stone Tool category is again poorly represented. Only four out of five sites have tools, and the range of tool types found is from one to three. The Cobble Stone Tool Industry is again important, being associated with four out of five sites. Spalls are the most common tool type.

Inferred Observation Posts

All sites are located on the prairie uplands. More specifically, three sites (EdNf-37;

EdNf-43; EdNf-46) are located on valley spurs, which give an unobstructed view of the valley. Three of the sites are also in proximity to designated wintering areas.

Both the Chipped Stone and Cobble Stone Industries are poorly represented (Table 35). Chipped Stone tools were found only at two sites; and at these sites the number of tool types was one and two. The General Debitage category was strongly featured at all sites. It was inferred that, during monitoring of game animals, lithic reduction activities might have been carried out to reduce boredom.

Inferred Winter Campsites

Out of the 13 sites designated as wintering areas, eight are associated with dry stream beds, while another site is being eroded away by the waterway; all situations reflecting strongly that the geographical position of contemporary Wascana Creek is of recent origin (Fig. 14).

Ten (77%) of the sites are located on the floodplain, while the remaining sites (23%) are on higher levels (terraces). All sites are associated with treed northern exposure slopes: five sites are associated with northeast-facing slopes; five sites are in proximity to northwest-facing slopes; one site lies along a north-facing slope. One large site (Sherwood Forest I sites) covers the entire floodplain on both sides of the tributary. At all sites the waterway either cuts the associated slope wall, or is proximate.

The sites were large, and artifact densities were high. Bone was generally ubiquitous on all sites. In the General Debitage category pressure retouch flakes were identified at nine sites, suggesting the construction and maintenance of Chipped Stone tools. The most diagnostic feature was the abundance and wide variety of tool types in the Chipped Stone Tool Industry. With the exception of one site, the number of tool types ranged from five to 13 (Table 35).

The exception, the Baker I site, demonstrated only two tool types. It was designated a winter camp because of its close proximity to the Baker III winter camp directly across the tributary; it was inferred that the site might be an extension of the latter one. Recovery was poor from the site because it was a pasture, and artifacts were difficult to discern. Ceramics, however, were recovered, an important diagnostic of a winter camp. Ceramics were also present at eight other sites. It was inferred that winter camps should exhibit high frequencies of ceramics. This was not the case in the Wascana Valley. The Besant point type was the most abundant diagnostic; and it is not usually associated with high frequencies of ceramics (Dyck 1983:115). At the Gilmore I site, which is mainly related to a Plains/Prairie side-notched point type, ceramics were abundant.

Unnotched projectile points were identified at four sites, suggesting staged manufacturing of personal gear. Site furniture (mauls and pestles) were recovered from five sites. The Cobble Stone Industry was strongly represented, implying that butchering was an important function at the winter camps.

Inferred Spring Campsite

Only one spring campsite (Baker II) was identified; and it was located on the uplands directly above the Baker I winter camp. Another previously identified site (EdNf-13) is close by, and it is considered to be part of the same site. The site is extremely large, and artifacts are concentrated along the valley rim. Artifact densities are also high. The Chipped Stone Industry is strongly represented at the Baker II site. The number of tool types was ten. This large representation is consistent with the assumption that prior to major movements to the summer range, a high percentage of the winter tool kit would be abandoned to facilitate the movements.

Ceramics were not recovered from the Baker II site, but were found at EdNf-13. It was postulated that small frequencies of ceramics would occur at a spring camp, a carryover from the wintering area.

From an overall perspective, Chert was the most common raw material, followed by Silicified Peat and then KRF. In the point type category, Besant had the highest frequency.

It was identified at seven sites, followed by the Prairie/Plains side-notched type (6), and then Pelican Lake (2).

Qu'Appelle River (Fig. 15)

The following data base was derived from an unpublished report (Arthur et al 1975) on the Qu'Appelle Basin Archaeological Project. The research area begins at the town of Craven at the confluence of the Qu'Appelle River and Last Mountain Creek, and extends to the Piapot Indian Reservation.

All sites were defined as to type: campsite, tipi ring site, cairn, and kill site. Detailed descriptions were provided for only 29 out of 74 sites. These descriptions included physical features; cultural features, e.g., number and size of tipi rings; and broad descriptions of artifact assemblages. The environmental descriptions allowed for inferences to be made on additional sites in the vicinity of the described ones.

The 74 sites included 36 (49%) tipi ring sites, 26 (35%) campsites, seven (9%) kill sites, and five (7%) cairn sites. Of these sites, only two (3%) were located on the floodplain of the Qu'Appelle River. One was a large campsite (EeNe-1) situated at the confluence of the Qu'Appelle River and Last Mountain Creek (Fig. 15); and the other (EeNe-16) is a small campsite in proximity to the slope wall. Thirty (83%) of the tipi ring sites are located on the prairie uplands along the valley rim. Four of the remaining sites are in the main valley on lower slope areas, while two are located on terraces in a coulee coming into the main valley from the north.

Out of the 26 designated campsites, 17 (65%) were on the prairie uplands. The remaining sites have varied locations: two are associated with confluences; three are on mid-slope areas in the main valley; three are associated with coulees; and one is located on the floodplain. This site designation is problematic in that many of these upland sites are located on cultivated areas, and originally were probably tipi ring sites.

The kill sites understandably are all on lower slope, or bottom slope locations. Two are directly associated with coulees. There are five cairn sites which, with the exception of

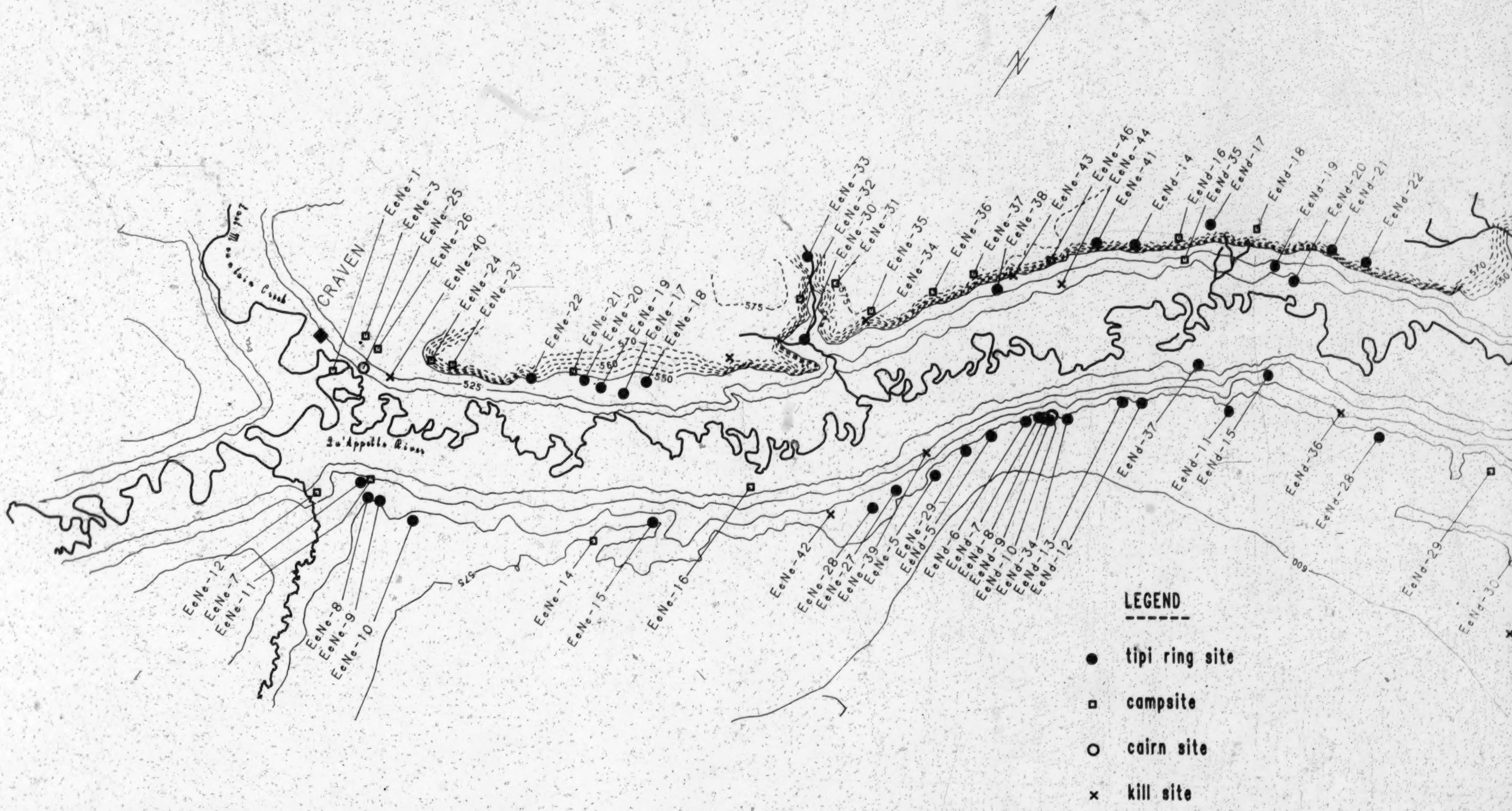
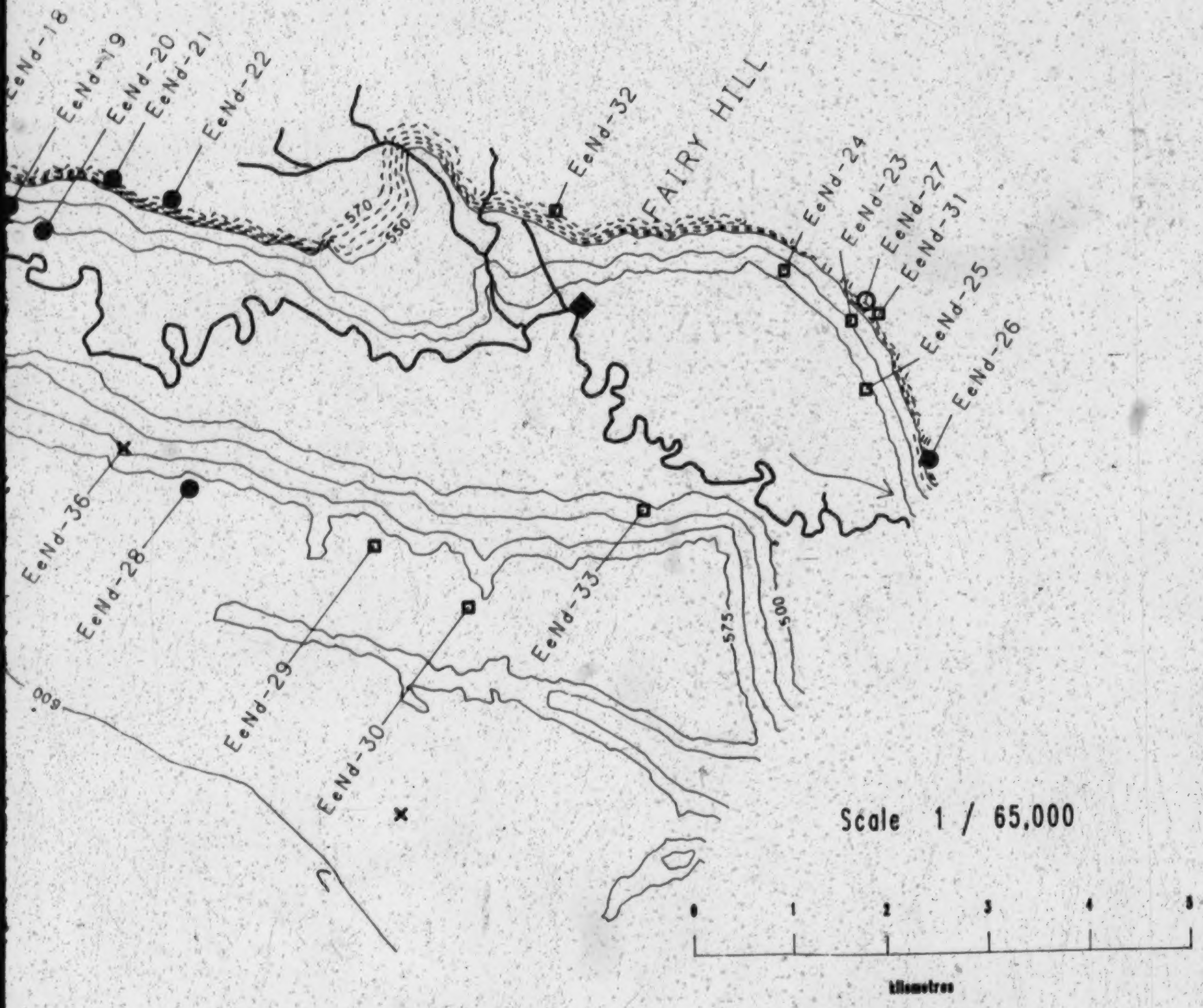

CRAVEN
Last Mountain Creek
Qu'Appelle River
EeNe-1
EeNe-3
EeNe-25
EeNe-26
EeNe-40
EeNe-24
EeNe-23
EeNe-22
EeNe-21
EeNe-20
EeNe-19
EeNe-17
EeNe-18
EeNe-33
EeNe-32
EeNe-30
EeNe-31
EeNe-35
EeNe-34
EeNe-36
EeNe-37
EeNe-38
EeNe-43
EeNe-46
EeNe-44
EeNe-41
EeNd-14
EeNd-16
EeNd-35
EeNd-17
EeNd-18
EeNd-19
EeNd-20
EeNd-21
EeNd-22
EeNe-12
EeNe-7
EeNe-11
EeNe-8
EeNe-9
EeNe-10
EeNe-14
EeNe-15
EeNe-16
EeNe-42
EeNe-28
EeNe-27
EeNe-39
EeNe-5
EeNe-29
EeNd-5
EeNd-6
EeNd-7
EeNd-8
EeNd-9
EeNd-10
EeNd-34
EeNd-13
EeNd-12
EeNd-37
EeNd-11
EeNd-15
EeNd-36
EeNd-28
EeNd-29
EeNd-30
525
550
560
570
575
600
N
LEGEND
● tipi ring site
▫ campsite
○ cairn site
× kill site

Figure 15: Qu'Appelle River archaeological sites


EeNd-18
EeNd-19
EeNd-20
EeNd-21
EeNd-22
EeNd-32
FAIRY HILL
EeNd-24
EeNd-23
EeNd-27
EeNd-31
EeNd-25
EeNd-26
EeNd-36
EeNd-28
EeNd-29
EeNd-30
EeNd-33
570
550
575
500
600
Scale 1 / 65,000
0
1
2
3
4
5
kilometres
Contour Interval - 25 metres
Ancillary contour interval - 5 metres

Modified from: Arthur et al., 1975, p. 221.

one (EeNd-37), are found in association with other site types; and will be discussed within that context.

The overall picture in the survey area is a clustering of site types around a specific physical feature. It was decided that the determination of settlement patterns would be best served by focusing on these site type configurations as the unit of analyses rather than specific site types. The site type combinations inferred as possible examples of settlement patterns in the research area are described in Appendix II.

A major feature in the main Qu'Appelle valley is the broad extent of the floodplain, which ranges from 1.3 to 2 km in width. The main waterway tends to meander centrally on the broad floodplain, and only infrequently approaches the valley wall. As previously suggested, spatial incongruity between shelter and surface water generally acts against the suitability of the main waterway as a wintering area. The archaeological record strongly supports this assumption; only two sites were recorded on the floodplain of the main valley.

Associated with the main valley are three site type combinations (1,2,3) that may be wintering areas, with related site types such as spring campsites, kill sites, and cairns. Only one of these wintering areas (site configuration 1; Appendix II) is found in the main valley (Fig. 15). The specific wintering area (EeNe-1) is found at the confluence of the main waterway and Last Mountain Creek. The site's suitability was greatly enhanced by the fact that the confluence occurs at the slope edge rather then more centrally, where exposure to inclement weather would be greater. The two other wintering areas are not directly associated with the main waterway. One of these areas (EeNe-12) is found on the floodplain of a large tributary just prior to its confluence with the main waterway; the other sites (EeNe-30,32,33) are located in a large coulee entering the main waterway. These areas provide sheltered conditions, and accessible water resources.

The vast majority of the sites are tipi rings clustering along the rim of the valley uplands, which are not associated with any wintering areas. The most important site type configuration includes tipi ring sites, cairns, and kill sites. These sites are often clustered around a coulee with natural springs, or an intermittent stream, which provide local water resources (site configuration 4, Appendix II). The kill site is usually near the coulee bottom. According to Weekes' (1948:14) informants, a suitable location for a pound is a natural drop such as a ravine. Tipi ring clusterings may also occur along the valley rim where the main waterway cuts the slope edge directly below. The main waterway, in this instance, becomes an accessible water source. Many of these site clusterings contain large numbers of tipi rings; and cover large areas, suggesting repetitive use. The main drawing feature would be the local availability of surface water resources; e.g., springs. The exposed nature of these sites suggests use during temperate conditions, most likely in spring when tipi stones are particularly necessary due to high winds.

Also along the main valley where lakes occur, spring fishing campsites would be found; as is demonstrated by the Lebret site, which is discussed in the site type classification.

In conclusion, the main Qu'Appelle waterway during normal climatic conditions would be occupied primarily in spring. Lakes in the main valley would be a major source of alternate food such as fish. The floodplain of the main valley was generally unoccupied; but wintering areas may occur at confluences, or in large adjacent coulees. The valley uplands are the main occupation areas, serving mainly as temporary stopover points during movements to the bison summer range. These areas are usually found near local water sources, and land forms such as coulees and ravines suitable for operating bison drives. During prolonged drought the main waterway may have been an important occupation area during the entire vegetative season.

DISCUSSION AND CONCLUSIONS

In this study ecological and ethnographic studies and the historical record were first drawn upon to test the primary hypothesis; and it was concluded that beaver play an important part in the conservation and maintenance of surface water in the Plains environment. In addition, it was inferred that the large tributaries provided the most suitable wintering areas for the early Plains occupants. Several more specific hypotheses were put forth to test these assumptions from an archaeological perspective.

If large tributaries provide the most favorable conditions for wintering, then large winter campsites and kill sites should reach their highest frequencies in the large tributaries. In the two tributaries, Wascana Creek (a large tributary), and Cottonwood Creek (a small/medium-sized tributary), the survey areas were of comparable extent, 37.6 and 38.5 river km respectively. Fifteen sites were designated as winter camps in the combined tributaries, of which 13 (87%) were found on the larger tributary. The evidence of kill sites was not as definitive; however, on Wascana Creek one kill site was conclusively identified, while two other areas were inferred as possible kill areas.

It was also proposed that on a small tributary limited surface water, particularly during drought, prevented most areas from being used with any degree of permanency; therefore temporary campsites should be the most common site type. On Cottonwood Creek 15 sites were identified, of which 10 (66.6%) were temporary campsites.

Cottonwood Creek was the ideal area for carrying out studies to determine if any relationships could be inferred between site formation and the availability of water resources. Modern agriculture was not extensive, and many areas on the valley bottom still retained natural prairie. Perhaps most important, the waterway has generally experienced few disruptions; so that many of the original stream beds still retained their viability. At the height of the recent drought, appreciable amounts of surface water were found at only six beaver-occupied areas, and at one abandoned dam/pond system. Three of these beaver-occupied areas were directly associated with archaeological sites: Volke I, a frequently-used temporary campsite; EdNe-3, a spring campsite; and Campbell I (a winter campsite) (Fig. 13). An abandoned beaver pond system was associated with the Thompson I site, also a winter camp.

Field research was not carried out in the main waterway of the Qu'Appelle Valley, but a previous survey provided information on site types and possible settlement patterns. Seventy-four sites were identified, of which only two (3%) were found on the floodplain; strongly supporting the assumption that the main valley was not suitable for human occupancy. One of these sites was a winter camp at a confluence. Two other wintering areas were identified in proximity to the main valley: one was in a coulee entering the main valley; the other was on a tributary near the confluence with the main waterway. Tipi ring sites, were the most common type (49%) on the prairie uplands. Spring fishing camps are found near lakes in the main valley. The Lebret site, described in the site classification, is one such site.

On the tributaries some broad characteristics were discerned for the individual site type categories. All site types have a distinct spatial positioning within the Valley Complex. Temporary campsites occur on the floodplain, generally in open conditions. Observation posts are found on the uplands, often on spurs which give an unobstructed view of the valley. Winter campsites are located on the floodplain in the vicinity where the waterway approaches, and/or cuts a northern exposure slope. Kill sites are found on the floodplain near treed ravines and coulees. Spring campsites, which commonly consist of tipi rings, are found on the prairie uplands along the valley rim.

Although not conclusive, a pattern of intersite positioning was also observed. This pattern was most fully developed with the Baker sites on Wascana Creek (Fig. 14). Located on the east side of the tributary, on the floodplain, is a large wintering area (Baker III, a and b). In close proximity to the north of this site, near a ravine, is a kill site (Baker III c). Directly above the wintering area is an observation post (Baker IV). From Baker III directly across the tributary is another wintering area (Baker I), which may be an extension of the former. Just above Baker I is a spring campsite (Baker II).

Some broad attributes, specific to site type, were also exhibited in the artifact assemblages. Activities inferred for the temporary campsites include initial lithic reduction and those associated with food preparation (butchering) and cooking. These activities are generally associated with the Cobble Stone Industry, which has a strong representation in this site type, especially in the repetitively-used type variation. Cobble spall tools are the most common tool type, and they are highly suited for both chopping and cutting activities.

The main activity proposed for observation posts is the monitoring of animal movements. The General Debitage category consistently dominates the lithic assemblage, the Chipped Stone and Cobble Stone Industries being poorly represented. Its prominence tends to confirm the assumption that lithic reduction activities were carried out to reduce boredom.

Some broad characteristics for the winter campsite are high artifact densities with bone generally ubiquitous throughout the site area; and the high representation of the Chipped Stone Industry. Chipped Stone tools are not only abundant, but exhibit a wide variety of types. Since the wintering area was occupied for a prolonged period of time, a wide range of activities would be carried out. Some more specific attributes are the presence of pressure/retouch flakes, reflecting the manufacture and maintenance of Chipped Stone tools; the presence of site furniture such as ceramics, mauls, and pestles; and a high frequency of unnotched projectile points indicating the staged manufacture of personal gear. The Cobble Stone Industry is strongly represented, and it was inferred that during winter butchering was an important activity.

Specific characteristics in the artifact assemblage that would be associated with the spring campsite are more difficult to discern. The Chipped Stone Industry is strongly represented, reflecting the assumption that, prior to major movements to the summer range, portions of the winter tool kit were abandoned to facilitate movements. Small frequencies of ceramics were also found, reflecting a carryover from the winter camp. However, there are other variations of the spring campsite type. As the groups moved to the summer range, there would be frequent stopovers, with the artifact assemblages exhibiting the characteristics of a temporary campsite.

On the main waterway, one of the site type configurations inferred for the tributaries was also present. One of the winter camps was associated with a kill site, and tipi rings and cairns were present on the uplands directly above. Another intersite configuration consisted of tipi rings sites and cairns on the uplands, and a kill site in a nearby ravine.

Briefly, using the sites in the research areas as a focal point, the reconstruction will follow the annual cycle of the early Plains occupants. The Qu'Appelle River Valley Complex lies on the southern peripheries of the bison winter range (Fig. 4). The aboriginal groups would occupy a wintering area (e.g., Baker III) on the floodplain of Wascana Creek (Fig. 14). Just prior to ice breakup, they would cross the tributary and take up spring residence on the prairie uplands (Baker II). They would then move directly to the summer range. In the fall they would return, via the smaller tributaries, to their wintering areas. Cottonwood Creek would be one of those migration corridors. During normal climatic conditions, areas suitable for wintering (Thompson II; Campbell) would be occupied (Fig. 13). During prolonged drought wintering areas on Cottonwood Creek would be abandoned; and movements to the summer range would be suspended for both human and bison populations. Large herbivores (bison, elk, deer) would be drawn to the main waterway (Qu'Appelle River), where appreciable amounts of water and forage would still be found. As a result, the tipi ring, cairn, and kill site type clusterings on the uplands of the main valley (Fig. 15) could represent two different functions. During normal climate they would be temporary spring stopovers during major movements to the bison summer range. During drought they could be occupied for much greater duration. The human populations would also be drawn to the main waterway, to pound the bison herds that had gathered there. Site occupancy could extend from spring to late fall. As winter approached the people would move to the sheltered areas in the large tributaries.

CHAPTER VII

THE MODEL AND THE HISTORICAL SETTING

INTRODUCTION

This chapter first presents the more developed and/or specific model of man/animal relationships that evolved on the Northern Plains prior to contact and the acquisition of the horse. The chapter then examines how changing conditions, beginning in the protohistoric period and culminating in the historic period, affected and significantly altered the theoretical model (traditional relationships) of animal and human interactions verified in the preceding chapters. The major focus is the definition of the role that the aversion to beaver hunting played in the developing relationships.

The Historic Period has two chronological parts, delineated by events that set the stage for many of the evolving relationships. The first part generally includes the dynamics between 1763 and 1821: 1763 signifies the signing of the Treaty of Paris which decreed the cession of Canada, by France, to Great Britain; 1821 refers to the merger of the Hudson's Bay and North West Companies. The final period continues from 1821 until the end of the bison hunting tradition, marked by the destruction of the herds in the late nineteenth century. The horse, because of its pronounced impact on the aboriginal way of life, will be discussed in a separate section.

The vast range of variables and interactions precludes the possibility of a complete understanding of the systemics of the historic period. However, by focusing on some of the more important components and interrelationships, a sense of the overall dynamics can be conveyed.

THE MODEL

Drawing on the field research (archaeological and ecological) in the Qu'Appelle Valley, and using the annual man/bison seasonal round on the Canadian Plains as a time frame, the following analysis will present a more specific model of man/beaver relationships, and consequently settlement patterns that evolved prior to contact

In the plains ecosystem surface water and treed areas are of limited abundance and mainly restricted to the Valley Complex systems, which were focal points in the movement and settlement patterns of the early Plains occupants. In addition surface water is subject to marked fluctuations in availability, both seasonally and from year to year.

During the annual cycle it is only during spring that surface water was not a limiting factor, allowing the early Plains occupants to follow the herds across the open plains to the bison summer range. However, by fall, the availability of surface water becomes a critical factor as local water surpluses have evaporated and the remaining surface water is primarily restricted to (in this case) the mainstreams of the Saskatchewan/Qu'Appelle Valley Complexes. At this time the importance of beaver in maintaining surface water comes into play,.and strongly determines the specificity of human movement patterns. The return to the winter range would essentially entail locking into the Valley Complex networks. The small/medium-sized tributaries (e.g., Cottonwood Creek) would serve primarily as migration corridors as the groups moved inward to their wintering areas on the larger tributaries. Because surface water is not abundant, smaller tributaries tend to be intermittent, and by fall surface water of any appreciable amounts tends to be restricted to beaver-occupied areas.

Several factors contribute to the storehouse effect of beaver dam/pond systems. An important factor is the beaver's choice of habitat which is restricted primarily to a specific spatial configuration,i.e., when the waterway is in proximity to a treed northern exposure slope. Treed northern slopes increase snow capture, so that the associated beaver pond, usually the primary dam/pond unit, receives significantly larger amounts of of spring runoff than other areas. If the slope also has breaks, such as coulees and/or gullies, these features are even more effective in snow capture and also act as catch basins for precipitation, which retards water loss during the vegetative season. The structural nature of beaver dam/pond systems is the most significant factor in surface water maintenance. Primary dam/pond units, which contain the lodge, are significantly deepened and widened to provide accessibility to the food cache in winter. Because they are deep, and regulated by secondary dam/pond units, these primary ponds are highly resistant to evaporation. Primary dams, which are compact and triangular in cross-section, also contribute to the conservation of surface water in the associated ponds; as water levels drop, correspondingly the dam becomes more impermeable.

Because basic habitat preferences for both beaver and human populations were similar (sufficient water in proximity to treed areas), early Plains occupants were drawn to these areas. These essential resources were enhanced directly or indirectly by the presence of beaver. The major advantage of beaver activities was the conservation and maintenance of surface water in specific areas. Beaver dams also raised water tables that not only benefited the associated tree/shrub species, but grasslands continued to grow and remain green longer. Herbivores such as elk and deer would be attracted to these areas providing additional food sources. By felling tree/shrub species beaver also supplied dry firewood and construction materials.

Most archaeological sites on Cottonwood Creek were associated with the above habitat configuration. Because surface water is least abundant in a small tributary, it is most susceptible to climatic perturbations and thus highly unstable. These conditions are also reflected in the archaeological record. Temporary campsites were the most common site type. and only rarely were conditions suitable for winter occupation. These sites represent temporary stopovers during fall movements to the wintering areas

On a large tributary surface water is significantly more abundant and stream flow generally is continuous during the entire vegetative season. As a result treed areas are more abundant and not restricted to northern exposure slopes. Although the beaver still exhibit the habitat preference established for a small tributary, a broader spectrum of suitable habitats is available. Consequently beaver dam/pond networks are more extensive, and thus regulate and maintain a broader area of surface water. This greater stability is reflected in the archaeological record. Winter campsites reach their highest frequencies on a large tributary (e.g., Wascana Creek), and are primarily associated with the habitat configuration established as best suited for human/beaver occupation. The winter campsite is closely associated to several other site types reflecting a site type configuration that may be representative of a more specific and or localized settlement pattern in the large tributaries. Kill sites are found on the floodplain near treed ravines and coulees; and usually are proximate to the winter camps. Observation posts (for monitoring herds) often may be found on the uplands above the wintering areas, or on more elevated slopes. Spring campsites are also nearby on the valley uplands.

On the main waterway surface water reaches its greatest abundance. Strong stream flow acts against beaver dam/lodge construction so that beaver contribute little to the direct maintenance of surface water. However, beaver populations that are regulating stream flow in the tributaries contribute to the continued flow in the main waterway. The main waterway, in this case the Qu'Appelle river, tends to be positioned centrally on an extremely broad floodplain, leading to spatial incongruity between surface water and treed and/or sheltered areas. The archaeological record again reflects these ecological conditions as sites in the main valley are rare and restricted mainly to confluences. However, there are large site type clusterings of tipi ring/cairn/kill sites on the prairie uplands. They may under normal climatic conditions represent temporary spring stopovers during major movements to the bison summer range.

During drought marked changes occur in the plains environment. The most significant is a progressive decline in surface water availability, which is most pronounced in the small tributaries. At the height of a drought cycle, because of dry falls and winters, surface water resources are decimated. The smaller tributaries become dry stream beds dotted infrequently by isolated beaver ponds, mostly abandoned by their beaver populations. By this time both bison and human populations would have suspended movements to the bison summer range. Most beaver occupied areas on a large tributary would exhibit sufficient resilience to withstand the drought so that most human wintering areas should not be adversely affected. Most faunal forms, including beaver and large ungulates such as bison,deer etc., would have been drawn to the main waterway because essential resources (water and forage) would be concentrated there. Water resources on the main waterway would also have exhibited marked losses so that beaver may have been forced to began constructing dam/pond systems to maintain a sufficiency of water, again contributing to the maintenance of a scarce resource. The Plains peoples would have been similarly drawn to these areas, from spring to fall, to pound the bison off the valley slopes. Prolonged drought conditions may be the more accurate explanation of the high frequency of tipi ring/cairn/kill sites on the upper slopes and uplands of the main valley. With winter freezeup the Plains groups would return to their winter camps in the large tributaries.

Drought conditions particularly bring into focus the critical role of beaver in stabilizing and maintaining surface water in the plains ecosystem. Without beaver most areas in Valley Complex systems would have been uninhabitable

THE HISTORIC PERIOD

The above model provides us with a more comprehensive picture of the human ecology of the pre-horse/fur trade era on the Northern Plains. We are now in a position to understand the cultural variability exhibited by the various tribes during the historic period, and especially their variable response to and role in the fur trade. Oliver has observed:

> ...that there are important differences among the sociocultural systems of people who live in different ecological situations, and it does offer a reasonable explanation for the similarities among the Plains tribes,

> aswell as the differences which persisted between them to the end (1962:68).

Some of the cultural diversity exhibited during contact, which persisted well into the historic period can be directly related to the length of time the groups had been on the Plains, and hence were accustomed to a reliance on the beaver to maintain surface water.

Oliver also has stressed the role of technology, in this case the introduction of the horse, as a "prime mover"in cultural change on the Plains. He goes on to state that :

> This basic technological change [the horse] triggered a whole series of cultural modifications. However, it is not technology alone that is so important - it is rather the role played by technology in the total ecological system. The complex interrelationships between the technological systems and the environment of other men, other animals, and other societies were certainly key factors in the developing Plains situation (1962;68).

In this study the horse is also seen as playing a pivotal role in the irrevocable changes that affected the traditional man/animal relationships in the historic period; and will be discussed more fully in the following section.

The Horse

From a source in the vicinity of Santa Fe, New Mexico, there were two lines along which horses were distributed north: one by way of the Great Plains, and the other to the west of the continental divide (Haines 1938:436). The latter route went to the Snake River, along which the Navaho, Apaches, Ute, and Shoshone distributed horses to the Pacific Northwest. Haines (1938:436) suggests that the Blackfoot obtained their horses from the Shoshone; but Ewers (1955:19) disagrees, stating it was more probable that horses were obtained from the Flathead, Kutenai, Nez Perce, or Gros Ventre. Ewers (1955:18) broadly places the acquisition of the horse by the Blackfoot within the second quarter of the 18th century, and also suggests that the horse may have diffused to the Assiniboine and Plains Cree from the Blackfoot and Gros Ventre.

Research into the impact of the horse on indigenous populations has resulted in widely divergent opinions. Jenness (1938:263) claims that the ease with which bison could be hunted on horseback attracted forest tribes to the plains. Wissler (1914:13) and Roe (1955:218) both disagree with the view that the horse affected migrations. Wissler (1914:17) perceives the horse as simply intensifying original Plains patterns. Other authors claim that the horse had a profound impact on many aspects of aboriginal life. Ewers states, "... that the influence of the horse permeated and modified to a greater or lesser degree every major aspect of Plains Indian life (1955:339).

This study is in agreement with the interpretation that the horse strongly affected Plains life. The acquisition of the horse, however, was highly disruptive of the earlier pedestrian way of life; and the changes it brought were not always beneficial. As discussed in previous chapters, the central theme of Plains adaptations involved ecological knowledge as a major component of subsistence strategies. An understanding of their environment allowed Plains residents to predict natural events, some which they manipulated and enhanced. Through the non-hunting of beaver, water resources were maximized. Knowledge of fire allowed the regulation of bison movements. Knowledge of bison behavior also brought about the development of traditional communal hunting techniques that did not disrupt these predictable patterns.

Given the above, early Plains populations were able to occupy the winter range from eight to nine months; and return to the same areas in subsequent years. Prolonged and repetitive use of an area was an important survival factor for a pedestrian people. The horse and its consequences were to disrupt these predictive patterns.

Morton (1929) points out one of the initial effects of the acquisition of the horse, i.e., greater mobility and thus greater accessibility, that was to alter territorial alignments strongly:

> Before the horses reached them the range of the tribe was limited by the mobility of the foot passenger. With the horse, the expansive prairie ceased to separate tribe from tribe (1929:LXXIV).

The greater mobility provided by the horse immediately fostered a new concern for territorial boundaries. More importantly, greater mobility provided the impetus for territorial expansion, with those acquiring the horse first having a tactical advantage over those that did not yet have it. Because expansion was not limited to occupation of unclaimed areas, population dislocations were common.

The southern Plains witnessed the most spectacular territorial changes and increased animosities as a result of acquiring the horse. The Comanche were relatively latecomers to the area, arriving about 1700 (Wallace and Hoebel 1952:6-8). They had acquired horses as early as or before the Shoshone (1952:39), and began their rapid expansion, claiming by 1836 a vast part of the Southern Plains as their own (Wallace and Hoebel 1952:34-36). For the Northern Plains, the earlier acquisition of horses allowed the Shoshone to penetrate as far as the Saskatchewan River in the early 18th century. This invasion resulted in a northward displacement of the Blackfoot tribes and possibly the Plains Assiniboine.

The emergence of a new hunting technique, the chase on horseback, contributed greatly to the disruption of bison movement patterns during the historic period. Ewers, however, claims:

> This new hunting technique [the chase] was more efficient and adaptable then any method previously employed. Not only did it require a fraction of the time and energy but it was less dangerous and more certain of success than other methods (1955:305).

Ewers (1955:304) more specifically implies that the operation of bison drives by pedestrian peoples must have been very dangerous and time-consuming, and sometimes resulted in failure. He further states that the migratory habits of bison and the limited mobility of the pedestrian groups must have caused periods of food scarcity, particularly in winter. Ewers (1955:129), however, was under the assumption that the operation of drives did not extend past November and December, leading him to conclude that:... the greatest advantage horse users enjoyed over their pedestrian ancestors lay in their ability to transport quantities of dried provisions to their winter camps in the fall of the year as insurance against hunger and starvation during the most inclement winter months (1955:304).

Arthur (1975:121), on the basis of extensive historical documentation, concluded that bison drives (jumps and pounds) were used effectively throughout the winter; and that the production of large amounts of dried provision in fall was neither undertaken nor necessary. He further notes that the horse was not a casual factor in the existence of large encampments, given that the horse-poor Cree and Assiniboine always wintered in large camps; rather it was the presence of large bison herds (1975:122).

As for drives being dangerous, it would have been the exception rather then the rule. A drive is a hunting technique the success of which is dependent on manipulation and stealth; therefore those individuals taking part in its operation are only infrequently placed in positions of direct confrontation with the herds. On the other hand, the chase, with its straightforward rush into stampeding herds, was fraught with dangers. In describing a chase on horseback, Garretson notes:

> The dangers, of course, were many and accidents occurred on almost every hunt of any size, some of which were fatal. Occasionally in the excitement of the chase and careless handling of weapons, the hunter shot and killed his own horse (1938:104).

The historical record shows little evidence to suggest that the horse made any essential contribution to the successful operation of a drive, and in actuality was often considered as a disruptive factor.

Arthur (1975:94) states that horses were seldom used to bring the herds to the drive site, but if the herd had already been enticed to the mouth of the drive lines, horses could be used to stampede it into the pound.

According to Henry:

> Horses are sometimes used to collect and bring in buffalo, but this method is less effectual then the other; besides, it frightens the herds and soon causes them to withdraw to a great distance. When horses are used, the buffalo are absolutely driven into the pound, but when the other method

> is pursued they are in a manner enticed to their destruction (in Coues 1965:520).

The suggestion that the chase was a superior hunting technique, as compared to the traditional drives, is also debatable. The traditional drives continued to fulfil the same functions in the horse era as they had in the previous pedestrian culture. As previously noted, the success of these hunting techniques lay in the enticement of the herds to kill sites with a minimum of disruption; the result was that the herds continued to be present in an area for subsequent hunting. Continued occupancy of the wintering areas, particularly during adverse conditions, would have greatly facilitated survival during the horse era as well as prior to contact. The nature of the traditional hunting technique enhanced this possibility. Ewers (1955:304) admits that the horse was generally not suitable for winter hunting, especially during adverse weather conditions. Given the consequences of the operation of a chase (the disruption and dispersal of the herds), the frequent or repetitive use of this technique would have seriously jeopardized the possibility of winter hunting areas being maintained for any extended period.

Admittedly from a short-term perspective the horse made it easier to follow and hunt the herds during their dispersal to the summer range. There is also one time during the annual cycle that the chase would have been effective without the consequences of serious herd disruption, and that was during the rut. As I have previously noted, "the resulting dispersal of the herds, one of the detrimental effects of the chase, is temporary - the attractions of the rut favoring a resumption of the large groups" (Morgan 1979:189).

From a long-term perspective, however, the continuing pursuit of the herds on horseback severely disrupted bison movement patterns, diminishing considerably the possibility of their return to specific wintering areas. Moodie and Ray (1976) agree that hunting mobilized the herds and scattered them over large areas. As supportive evidence they quote the remarks of the post journalist at Fort Edmonton in January of 1822:

> ... we are anxious, to have a number of these animals killed as quick as possible, fearing, that the different tribes of Indians, who are daily in search of them, and chasing

> them from one part of the Country to other, will drive them out of our reach (1976:50).

Since the Indians could no longer depend on the herds to appear at their former wintering areas, the horse's mobility was now needed more frequently to search for them, further exacerbating the situation. Consequently, the Indian tribes would have been forced to make increasingly more frequent moves during the winter; and the opportunities for the construction and operation of traditional drives would have been considerably reduced. Arthur (1975:100) also suggests that the reduced use of drives in the horse period was due to the increasing unpredictability of herd movements. The continued harassment of the herds also altered their behavior, making them more wary and skittish. These behavior changes also would have seriously affected the successful operation of the drives, but not the chase on horseback.

In brief, the general pattern of hunting strategies in the historic period was the use of drives from fall throughout the winter (Arthur 1975:121). The chase was the preferred hunting technique during the spring and summer (Mandlebaum 1940:191; Ewers 1958:76). The drives were discontinued because the chase on horseback disrupted the predictable patterns upon which the successful operation of the drives was dependent. Although the horse created these uncertainties, its mobility also provided the solution, intensifying the above conditions. The chase on horseback was an important contributing factor to the increasing nomadism that pervaded the historic period.

The implication that in the historic period the drives fell into disuse because of replacement by superior hunting techniques (the chase) is untenable. The traditional drive (pound or jump) was one of the most successful developments in the subsistence strategies of the early bison hunting tradition. Forbis notes,

> With the horse, which first appeared between A.D. 1700 and 1750, methods of hunting changed; and though the practice of driving the buffalo was then largely forsaken, it is by no means certain that this practice produced a less abundant livelihood (1962:69).

Jumps and pounds continued to fulfil the same functions in the early historic period.

During the horse era the intensification of warfare also contributed significantly to the disruption of the bison herds. Moodie and Ray (1976) observed that in the early winter of 1813, "...the failure of the buffalo to approach the parklands along the North Saskatchewan in early winter was attributed to the Blackfeet massing for an attack on the Assiniboine" (1976:50). There is general agreement among most authors that these increased tribal animosities could be directly related to the horse.

Ewers notes:

> It was the continuing economic need for horses, periodically heightened by serious losses of horses from enemy raids, destruction by plagues or severe winter storms, that made horse raiding the most common form of Blackfoot warfare and tended to perpetuate this type of warfare (1955:312).

Secoy (1953:58) claims that because the Blackfoot captured more horses than the Cree and Assiniboine, with whom they were originally allied, tensions were created which led to their separation into hostile camps. In concurrence with this interpretation, Mandlebaum observed, "...that the unceasing hostility between the Plains Cree and their enemies was not due to any dispute over territory or struggle for trade advantages, but was largely the result of the continual raiding and counter- raiding for horses" (1940:195). Henry noted that, "The Crees have always been the aggressors in their disturbances with the Slaves [Blackfoot]..." (in Coues 1965:540). Increasing warfare, stimulated by the need for horses, was also greatly facilitated by the horse's mobility. As Morton states, with the horse, "It [the prairie] rather became a highway by which a whole tribe could strike a distant foe as swiftly and suddenly as a bolt from the blue" (1929:lxxiv). Thus, every group was accessible and all were vulnerable; thus increased mobility became an essential factor in survival.

> '... the endemic raiding warfare of the Plains area put a premium on flexibility and mobility, for both offense and defense. A group that was tied down in one place was a sitting duck; what was needed was a reasonably large group that could move in a hurry and react quickly (Oliver 1962:53).

The habitat requirements of the horse also contributed to the increasing nomadism of the historic tribes. Ewers (1955:41) observed that bands with large numbers of horses were often forced to move the winter camp several times in order to secure sufficient pasturage.

In summary, the acquisition of the horse brought about both the development of a new hunting technique (the chase) which disrupted the bison herds, and it increased inter-group conflict (mostly horse raiding); in the end, it placed a premium on mobility for survival. These developments seriously disrupted the previous pedestrian bison hunting tradition. Although the horse created these uncertainties, its provision of mobility also provided the "solutions", which further intensified the situation. The historic period was thus a time of intensified nomadism and tribal animosities that directly related to the acquisition of the horse. Black similarly noted that "The horse made nomads of many tribes which there is abundant evidence to show were formerly almost sedentary in character" (in Roe 1955:176). In a slightly more philosophical vein, Bancroft reflected:

> It is by no means certain that the possession of the horse has materially bettered their condition,. Indeed by facilitating the capture of buffalo, previously taken perhaps by strategem, by introducing a medium, with which at least the wealthy may always purchase supplies, as well as by rendering practicable long migrations for food and trade, the horse may have contributed somewhat to their present spirit of improvidence (1886:283).

1763-1821

Following the Treaty of 1763, trading posts held by the French were abandoned in Manitoba and Saskatchewan. However, Montreal Pedlars began to expand into the interior along the Saskatchewan River. In 1768 the trade restrictions imposed by the 1763 treaty were rescinded, opening up the West to all traders. The influx of rival groups into the interior forced the Hudson's Bay Company into constructing inland posts. During this period, and until the 1821 amalgamation, the Hudson's Bay Company's major competitors were a series of North West Companies (Ray 1976:125-126).

The fur trade also expanded into the Athabasca and Mackenzie River basins, a movement which posed serious problems to both companies. The boreal forest could not provide sufficient food to feed their men. The parklands/prairie areas became the source of provisions for the western fur trade. To collect provisions, the Hudson's Bay Company and the North West Company built posts along the North Saskatchewan, Red, and Assiniboine Rivers between 1770 and 1881. In 1779 Hudson House was built on the North Saskatchewan River by the Hudson's Bay Company to obtain provisions (Fig. 11). The foodstuffs supplied were primarily dried buffalo meat, pounded meat, grease, and pemmican. The butchering and processing was done by native women (Ray 1984:263-264). These two events - the establishment of direct trading with the Indians by the fur trading companies; and the development of the provisions market - would have a profound effect on the relationships between the various Indian tribes, and in turn with the Companies.

According to Ray (1976), increased conflict between the Blackfoot tribes and other groups, e.g. the Assiniboine and Western Cree, was due to the fact that the fur trade had undermined the economic basis for cooperation between them. The latter groups were no longer able to operate as middlemen, but were forced to compete with the other groups to obtain the same goods for trade at the posts (1976:104). Secoy (1953) also stresses the replacement of Indians by Europeans in the function of collecting furs as a major change; however, he does not perceive it as a cause of increased animosities. He suggests that the Indians acting as middlemen were actually relieved to relinquish this activity, because at best it was only a part-time occupation. He notes:

> ...that the Indian hunting subsistence economy could not produce a surplus sufficient to maintain separate classes of individuals with specialized functions. Thus each individual was forced to allocate his available time among all necessary activities (1953:48).

My investigations of the historical record support Secoy's claims. As previously noted the Woodlands Cree and Assiniboine acted as middlemen to the Plains groups, which included their own plains-oriented groups. These Plains groups, however, did not trap valuable furs such as the beaver, the main trade item at the posts. The Woodland groups trapped the fur bearers themselves; and they also acted as middlemen for their own kin that chose not to make the long journey to the posts.

In the northern forest the result of this changed situation was much different. The Cree had been middlemen by conquest, driving many Athabascans out of their territories, and pillaging them of their furs. Direct trade allowed these disposed groups to obtain guns and ammunition, putting a stop to the Cree advance, and in many areas forcing them to retreat (Mackenzie 1802:50; Secoy 1953:49). However, Mackenzie (1802:50) in 1789 noted that the Cree had been and were continuing to be invaders of the Saskatchewan Valley from the East.

It has been stated that there was a regional distinction relating to the hunting of beaver: the Woodland Indians were beaver hunters, while the Plains tribes were not. This distinction was complicated by the fact that the Assiniboine and Cree were found in both divisions. The historic record provides more specific information on the geographical positioning of the various divisions. Mackenzie (1802:49) observed that the Indians beaver hunting were located at the source and on the northwest side of the North Saskatchewan River. The "strong woods" of the Beaver River and the upper valley of the Battle River were considered prime fur country. The Cree [Woodland], the most important beaver hunters, were located near the Beaver River (Morton 1929:lxiv); while the Strong Wood Assiniboine, who were also beaver hunters, were found near the Battle River (Morton 1929:34). The Plains Assiniboine were on the Assiniboine and upper Qu'Appelle. Harmon, a fur trader at Fort Alexandria on the upper waters of the Assiniboine, distinguished the Assiniboine in this area as non-beaver hunters:

> The Indians who come to this Establishment are Crees & Assiniboins ... . The former generally remain in the strong or thick Woods and hunt the Beaver, Moose & Red Deer &c. but most of the latter live out in the spacious Plains and hunt the Wolves (of different species) Foxes, Bears & Buffaloe &c. (in Lamb 1957:41).

McDonnell (in Masson 1960:Vol.I:281) similarly observed that the Assiniboine on the Assiniboine river were not beaver hunters. In addition Glover (1962:157) notes that Fort

Esperance was established on the Qu'Appelle River in 1787 mainly to obtain buffalo meat from the Assiniboine (Fig. 11).

The information on the Cree is not as conclusive. As early as Cocking's time (1772) there were some plains-oriented Cree on the Saskatchewan Plains (in Burpee 1908:106). However, as late as 1789-1793, Mackenzie (1802:50) noted that the Cree [Woodlands] were still advancing onto the interior Plains from the east. Conditions were different at this later time: the Cree possessed guns and were acquiring horses. They still exhibited Woodland traits (beaver hunting), but at the same time were acquiring Plains-oriented traits (pounding bison). However, the Plains-oriented Cree were a sufficiently visible and distinct group for Henry to imply (after 1808) a Woodlands/Plains distinction, which included a reluctance to trapping for furs. He noted (in Coues 1965:512-513) that the Cree who lived in the strong wood country were able to purchase trade goods, while the Cree in the Plains would not procure furs to purchase the same articles. Morton (1973:455) also refers to the Cree as one of the great equestrian tribes that roamed the plains and traded only skins of buffalo and wolves. What also complicated the analyses is that the fur trade record of Indian trade items did not always distinguish these intra-tribal divisions, and both divisions often traded at the same post. John McDonald, while wintering at Fort George, observed:

> The tribes of Indians who visited us during the winter were the Strong Wood and Prairie Crees: the Strong Wood and Prairie Assiniboils, the savage Blackfeet, the Piegan and Blood Indians.. (in Masson 1960:Vol:I:17).

The Plains groups during the early part of this period were relatively independent of the trading posts. As McGillivray noted:

> The Inhabitants of the Plains are so advantageously situated that they could live very happily independent of our assistance. They are surrounded with innumerable herds of various kinds of animals, whose flesh affords them excellent nourishment and whose Skins defend them from the inclemency of the weather, and they have invented so many methods for the destruction of Animals, that they stand in no need of ammunition to provide a sufficiency for

Luxuries listed by McGillivray include rum, tobacco, and ammunition. But he also points out that ammunition,

> ...is rendered valuable by the great advantage it gives them over their enemies in their expeditions to the Rocky Mountains against the defenceless Slave Indians, who are destitute of this destructive improvement of War (in Morton 1929:49).

The increased need for guns and ammunition was the Achille's heel of the Plains Indians, with disastrous consequences in their relationships with their enemies. And accessibility to guns and ammunition was largely determined by one distinction: whether or not the group hunted beaver. The beaver hunters were highly favored by the traders, and given preferential treatment. McGillivray, a fur trader at Fort George on the North Saskatchewan (Fig. 11), provides a detailed discussion of the privileges and advantages bestowed on the beaver hunters when they arrived at the post (in Morton 1929:30). He also notes that:

> Before their [beaver hunters] departure they are equipt with Ammunition, Tobacco and many other articles as exigencies may require, and this is renewed as often as they come to the Fort. This with little difference is ye manner in which the Beaver Hunters are treated, but the Gens du large consisting of Blackfeet, Gros Ventres, Blood Indians, Piedgans &c., are treated with less liberality, their commodities being chiefly, Horses, Wolves, Fat & Pounded meat which are not sought after with such eagerness as the Beaver (in Morton 1929:31).

The Plains Indians thus lacked the commodities with which to procure a sufficiency of arms. The advantage of the gun lay in its ability to kill, as arrows could be deflected by leather armour. According to Thompson, "A war party reckons its chance of victory to depend more on the number of guns they have than on the number of men" (in Glover 1962:45).

The crisis came to a head in 1793 when a group of Gros Ventre were exterminated by the Cree near the South Branch Houses on the Saskatchewan River. Both Morton (1973:456) and Johnson (1967:xviii) concur that the superiority in arms that the Cree could purchase, because of their trade in beaver and other prized furs, was the deciding factor in the defeat of the Gros Ventre. Morton notes, "Thus the Fall Indians continued the prey of their well-armed foes" (1973:456). McGillivray observed that the Gros Ventre thus perceived the fur traders as allies of their enemies, and in the winter of 1793-4 attacked the posts of both trading companies (in Morton 1929:62-4). This event later led to the southwesterly retreat of the Gros Ventre from the Upper Qu'Appelle and lower South Saskatchewan Valleys (Ray 1976:98).

Conditions were further intensified in 1809, when the London committee of the Hudson's Bay Company ordered that as few wolves as possible were to be traded, and dropped the Standard for wolves from one to one-half a beaver (in Johnson 1967:LXXIX) Since the concept of money was unknown to the Indians, the Hudson's Bay Company created a Standard unit of evaluation termed the "made beaver" (MB). An MB was the equivalent to the value of a beaver skin, and the prices of all other trade goods were expressed in terms of it (Ray 1976:61-62). The policy of not accepting wolf pelts as a trade item had already been in practice for some time at the North West Company (in Coues 1965:541). On hearing about these new policies while at Fort Vermilion (a North West Company post), Henry was led to comment, "This will be a fatal blow to the natives; it will deprive them of their usual supplies and probably make them troublesome" (in Coues 1965:559). His concerns were to prove prophetic, as two divisions of the Blackfeet tribes (the Blood and Blackfoot proper) became highly incensed and threatened to attack the forts, though in the end they did not (in Coues 1965:578).

A similar situation was developing on the Blackfoot southern frontier. Earlier in the century, and with only a few guns, the Blackfoot tribes, allied with the Cree and Assiniboine, were able to drive the Shoshone back to the Missouri and the Kutenais across the Rocky Mountains. With the establishment of trading posts in the Rocky Mountains, the Flathead tribes and Kutenai, not being averse to trapping beaver, were able to acquire guns and ammunition. In the summer of 1810, Thompson (in Glover 1962:306) observed that the newly-armed Flathead decided to march to the Plains to hunt bison. In an ensuing battle the Piegan were forced to retreat. Thompson's comments at the time were that;

> This was the first time the Piegans were in a manner defeated, and they determined to wreak their vengeance on the white men who crossed the mountains to the west side; and furnished arms and ammunition to their Enemies (in Glover 1962:306).

Henry's version of the consequences of the above battle revealed a more cautionary behavior on the part of the Piegan, as well as insights into the dilemma they faced:

> They [Piegans] fain would wreak their vengeance upon us, but dread the consequences, as it would deprive them in future of arms and ammunition, tobacco, and above all, their favorite liquor, high wine, to which they are now nearly as much addicted as those miserable tribes eastward (in Coues 1965:713).

The majority of the Piegan were not beaver hunters. Henry (in Coues 1962:723-724) observed that only about 30 to 40 tents, in the woody country, hunted beaver. The tribe was faced with the same problem as the Gros Ventre; to find a commodity with which to purchase sufficient guns and ammunition. One of the alternatives, particularly among the Blackfoot tribes, was to seize forcibly the beaver pelts from their enemies, most commonly white trappers. At Fort Vermilion in 1809, Henry, while complaining about the poor quality of furs brought to the fort by the Blackfoot, observed that, "Last year, it is true, we got some beaver from them; but this was the spoils of war, they having fallen upon a party of Americans on the Missouri, stripped them of everything, and brought off a quantity of skins" (in Coues 1965:541). Although Blackfoot did not trap beaver, it was apparently acceptable to trade those trapped by others.

The Gros Ventre, because of their inferiority in arms, continued to be the casualties of war. In 1811, while Henry was at Rocky Mountain House, he reported that the Gros Ventre, who had just been defeated by the Crow, were unable to obtain guns and ammunition because of the rejection of their furs. As a result, they were threatening to attack the post. He goes on to state that the Piegans managed to dissuade them by providing them with:

> ...all the dried provisions they needed, and represented to them the fatal consequences of such an affair; for surely never more would they see any traders in their lands, and where then could they get arms, ammunition, tobacco, and liquor? They would then be miserable indeed. The Piegans advised them to make buffalo robes with which to purchase ammunition to defend themselves... (in Coues 1965:721).

The Piegan thus cautioned the Gros Ventre on the repercussions from attacking the forts. According to Morton the Blackfoot tribes decided that, "The Company was there for trade; not for war, therefore 'hands off the company' was the policy generally followed" (1927:98).

The Plains Assiniboine did not have the same degree of difficulty in procuring guns and ammunition as the Blackfoot tribes and the Gros Ventre. They were able to obtain armaments by trading with their allies the Cree. Henry notes, "If they [the Cree] procure a gun, it is instantly exchanged with an Assiniboine for a horse" (in Coues 1965:513).

In many cases the fur traders were willing participants in escalating tribal animosities. Guns and ammunition were traded for the express purpose of warfare. While Thompson was at Rocky Mountain House, he was informed by the Salish [Flathead] Chief that they were preparing for war with the Piegan and their allies, and required ammunition. Thompson notes, "...all this I knew to be true and reasonable, and reserving only a few loads of ammunition I gave him the rest..." (in Glover 1962:380). Undoubtedly the factor of beaver vs. non-beaver hunting strongly influenced the preferential treatment afforded the Salish over the Piegan.

As previously noted, the Blackfoot, being the frontier tribes,were able to capture the greatest number of horses from the Shoshone, Kutenai, and Flathead tribes. This disparity in horses between the Blackfeet tribes and the Plains Cree and Assiniboine contributed greatly to tensions, and the eventual cleavage of these groups into hostile camps. Raiding of Blackfoot horses by the Cree and Assiniboine became endemic. Given the events on the Canadian Plains during the early nineteenth century, the tribes of the Blackfoot confederation were under constant siege. The Cree and Assiniboine were threatening from the east, with the Gros Ventre (an ally of the Blackfoot) absorbing the major impact of the hostilities. In the southwest, the Crow, Flathead, and Kutenai were on the offensive, with the Piegan bearing the brunt of the attacks.

The Blackfeet made concerted efforts to prevent others from trapping beaver in their territories. Attempts to achieve this objective were the basis for the Blackfeet not allowing trading posts to be established in their territories. Morton notes that, "although willing to live at peace with the company the Blackfeet were not willing to allow trading posts to be maintained in their country" (1927.:98). He goes on to state that Bow Fort near Calgary, and Chesterfield House, at the mouth of the Red Deer River, were abandoned due to Blackfeet pressures (Fig. 11). Trappers in Blackfoot territories often met with dire consequences. In 1802, near Chesterfield House on the South Saskatchewan River, fourteen Iroquois and two Canadians, who had come to trap beaver, were killed by the Gros Ventre (in Johnson 1967:3112-14). Thompson (in Glover 1962:392) alludes to 350 hunters (mostly of French origin) being killed by the Piegan or Blackfoot during his acquaintance with the tribe.

During the early part of the nineteenth century the Blackfoot remained successful in keeping fur trading companies out of their American territories. According to Ewers (1958:50), the Missouri Fur Company built a fort on the Forks of the Missouri in 1810. The attacks by the Blackfoot were so constant that little trapping was done, and more than twenty trappers were killed. After only a year, the area was abandoned. It was not until 1831 that the American Fur Company was successful in establishing operations in Blackfoot country (Ewers 1958:57).

Although there was eventually an erosion of the prohibition against beaver hunting, there is little evidence for this time period that the Plains Indians were a major contributing factor to the destruction of beaver resources that was occurring in the Plains/Parklands of the Western interior. Briefly, until their merger in 1821, the intense rivalries between the Hudson's Bay and North West companies had led to the intense ruthless exploitation of fur and game animals in the western interior of Canada (Ray 1976:117). In forested areas beaver had long been exhausted, and most pelts taken consisted of less valuable furs such as marten and muskrat. Large game animals such as moose and caribou had also been severely reduced in the eastern forest (Ray 1976:118-121). In the Parklands the destruction of animals occurred at yet a more rapid rate. The habitat of fur bearers such as beaver, muskrat, marten, and fisher were concentrated in a few areas, leaving them highly susceptible to discovery and destruction. In the Assiniboine Valley, these animals were virtually exterminated. In the country lying adjacent to the Saskatchewan River between the forks and Edmonton House the beaver were also decimated, though low-value furs such as wolves and foxes were still abundant (Ray 1976:118). Game conditions in the parklands were still favorable, with bison present in large numbers (Ray 1976:123).

The trading returns at the posts confirmed that the Plains groups were not participating in the beaver trade. At Fort George (North West Company Post) on the North Saskatchewan, McGillivray, in 1794, stated that the Blackfeet and Blood had, "traded 16 Bales of 50 Wolves each, 800 lbs. Pounded meat, with a sufficient quantity of Fat to employ twice as much, 20 Buffalo robes and 12 Bear Skins.." (in Morton 1929:46-47). In 1809 at Fort Vermilion, also a North West Company post on the North Saskatchewan (Fig. 11), Henry complained that:

> The trade with the Slaves [Blackfoot] is of very little consequence to us. They kill scarcely any good furs; a beaver of their own hunt is seldom found among them; their principal trade is wolves, of which of late years we take none, while our H.B. neighbors continue to pay well for them (in Coues 1965:541).

Similar conditions existed at the Hudson's Bay posts on the Saskatchewan. As reported in the Edmonton House journals between 1795-1800, whenever furs were traded by the Blackfeet, Blood, and Fall [Gros Ventre] they consisted primarily of wolves and foxes (in Johnson 1967). For example, in 1798, George Sutherland, stationed at Buckingham House, estimated that, "a tribe of Blackfoot Indians came in who brought upwards [in the equivalent] of 500 beaver in wolves and foxes..." (in Johnson 1967:132). At Chesterfield House, situated near the confluence of the South Saskatchewan and the Red Deer Rivers, Peter Fidler's trade in 1801 among the Blackfoot, Fall, and Blood Indians was the largest (12,000 MB) sent to London from York Factory (in Johnson 1967:LXXXVI); and according to Fidler's accounting consisted of foxes, wolves, and cats but no beaver (in Johnson 1967:319).

The question then arises as to what groups, and in addition nonhuman factors, were responsible for the decimation of beaver populations? Tomison, Chief of the Saskatchewan trade for the Hudson's Bay Company, places the blame firmly on the Eastern Woodland tribes. He notes:

> ...in the summer of 1801 the North West and XY Companies had brought in more than three hundred 'Eroquees' or Mohawk Indians' on three-year contracts. These Indians, who left 'nothing wherever they Come', had swarmed over the Saskatchewan District to complete the destruction of the beaver which had already been started several years back by the 'many Bungee Tawau Mischelemacana [and] Eroquee Indians' who had followed in the wake of the Canadians (in Johnson 1967:xci-xcii).

From a broader perspective, Thompson similarly observed that in the great western forest:

> ... the Natives had thus an anual supply of furrs to trade all they required, and had the furr trade been placed in the hands of one company under the control of govern[ment] might have continued to do so to this time; but from Canada the trade was open to every adventurer, and some of these brought in a great number of Iroquois, Nepissings and Algonquins who with their steel traps had destroyed the Beaver on their own lands in Canada and New Brunswick (in Glover 1962:229).

McGillivray's journal at Fort George gave insights into the identity of local Indian groups that actively participated in beaver hunting.

> The Country around Fort George is now entirely ruined.

> The Natives have already killed all the Beavers, to such a distance that they lose much time in coming to the House, during the Hunting Season. The Lower Fort will only therefore serve in future for the Gens du Large, whilst the Crees Assiniboines, and Circees, being the Principal Beaver Hunters will resort to the Forks (in Morton 1929:77).

White men also appear to have been major contributors to the destruction of beaver populations. White beaver trappers were generally of two categories: (a) Free Canadians (in Johnson 1967:152); and (b) Company Servants (in Morton 1929:76). With regard to the latter, McGillivray noted in 1795 that, "All the men are now returned from the Meadows [Plains]; they have Killed in all about 2,000 Beavers most of which are of the first quality" (in Morton 1929:76).

With regard to non-human factors, Ray (1976) has suggested that disease, fires, and drought may have contributed to the reduction of fur-bearing animals. He goes on to state that, "in the case of beaver, it may have been the combination of a particularly fatal epidemic at the beginning of the nineteenth century and the continued intensive trapping of the animal which led to its near extermination in many districts of the west" (Ray 1976:119).

The developing provision market, especially after 1812, eventually provided the Plains tribes with an abundance of trade items to purchase guns and ammunition, and other trade items. Increased European travel over the Plains also provided a market for horses (Secoy 1953:62). The Plains Indians had finally gained a high degree of independence, and often could dictate the terms of their relationships with the fur trading posts. In 1823 Simpson, Governor of the Hudson's Bay Company, being aware of this problem, was led to comment:

> The Plains Tribes ... continue as insolent and independent if not more so than ever; they conceive that we are dependent on them for the means of subsistence and consequently assume a high tone, but the most effectual way of bringing them to their senses would be to withdraw the Establishments/ particularly those of the Saskatchewan/ for two or three years which ... would enable us to deal with them on fair and reasonable terms... . This however cannot be affected until Red River settlement has the means of

> furnishing us with a considerable stock of Provisions for our Transport business (in Ray 1976:207).

According to Ray (1976:131), the increasing size of the provision market was the impetus for the Western Cree and Assiniboine to shift their focus from furs to provisions. This observation no doubt was true for the Western Cree, but as previously noted, since at least La Verendrye's time (1738) the Plains Assiniboine had been a distinct group and non-hunters of beaver.

A major problem with Ray's study is the omission of the Blackfoot tribes and the Gros Ventre from his analyses. As the earliest inhabitants of the Canadian Plains, they had been major participants in the provisions market since the establishment of the inland posts. As Ewers observed, the Blackfeet were not beaver hunters but:

> On the other hand, the Blackfeet loved to hunt buffalo.... They offered quantities of fresh meat, dried meat, and pemmican to the traders. Consequently, the Blackfoot trade became primarily a source of provisions for the fur traders who could use this food while they were engaged in their more lucrative quest for beaver among the Indians north of the Saskatchewan (1958:32).

As previously noted, the Edmonton House Journals (1795-1800) indicated that dried provisions were an important component of the trade goods brought by the Blackfoot, Fall, and Blood Indians to the post (in Johnson 1967). An accounting of goods brought to Fort George in 1794 by these groups also emphasizes the importance of provisions as a trade item.

By the early nineteenth century, the northwest movement of the Cree and Assiniboine had nearly stopped; and thereafter expansion was increasingly southward (Fig. 20). One of the most important changes was the abandonment of the Eastern Woodlands by the Assiniboine and Western Cree, who were replaced by the Ojibwa (Ray 1976:104). Mackenzie (1802:49) placed the Blackfoot tribes on the headwaters of the South Saskatchewan. According to Wissler (1910:8) this placement would include the area from the Red Deer River and southward. He positioned the Blackfoot proper northeast from the Piegan and Blood. Henry gives a precise definition of the territory of the Blackfoot tribes for the early nineteenth century:

> The tract of land which they call their own at present begins on a line due S. from Fort Vermillion to the South Branch of the Saskatchewan and up that stream to the foot of the Rocky Mountains; then goes N. along the mountains until it strikes the N. Branch of the Saskatchewan, and down that stream to Vermillion River (in Coues 1965:524).

Henry's southern border is not consistent, as he (in Coues 1965:240) also has the Piegan extending southward to the Missouri, which is probably more correct. According to Henry, the Gros Ventre resided south of the Blackfoot, between the South Saskatchewan and the Missouri (in Coues 1965:530).

1821-1880s

With the amalgamation of the two fur trading companies, George Simpson was installed as the new governor. He instituted a series of reforms to place the fur trade on a more economical basis (Ray 1976:195). One of his first efforts was to rejuvenate the fur trade, especially the beaver trade. To fulfill this goal he attempted to end the practices of taking summer furs and cub beaver, and the use of steel traps. His most important policy, one that would strongly affect the lives of the Woodlands groups, was the attempt to settle Indian families on a permanent basis in well-defined territories (Ray 1976:198:204). Faced with declining resources and a growing dependency on the Company, the Woodlands Indians were forced to accept most of the economic reforms (Ray 1976:213).

The Parkland Indians were initially able to resist most of the changes because of the Company's continued dependence upon them for food. However, this advantage was of very short-term duration. One of Simpson's economic measures was to cut the fur trade labour force by about two-thirds. Most of the men released were of Indian-European ancestry, and became known as Metis or Freeman. They soon became serious competitors with the prairie Indians for the provisions market. By the 1840s the Metis were bringing in more meat and pemmican than the Company required (Ray 1976:205-207).

By this time the reduction in the provision market for the Plains Indians was compensated by a growing market for buffalo robes. This demand was the result of the expansion of the American fur trade up the Missouri during the early part of the 19th century. The Hudson's Bay Company was never able to compete with the American fur traders for the robe and hide trade of the Plains Indians because of transportation costs. The Americans had a cheap transportation route via the Missouri and Mississippi Rivers, while the Hudson's Bay Company had to rely on an expensive overland route (Ray 1976:210-11). The growing market for buffalo robes was particularly a boon to the Blackfeet groups and the Gros Ventre, who whenever possible had used this commodity as a trade item since contact. Ewers observed that:

> They [the American traders] knew the Blackfeet were indifferent beaver hunters but would provide large numbers of buffalo robes. As the demand for beaver declined markedly after the invention of the silk hat in the early thirties, trade in buffalo robes increased, and the buffalo robe became the standard of value in the Blackfoot trade with the Big Knives [Americans] (1958:64).

In 1867 Issac Cowie at Fort Qu'Appelle made similar observations, noting that, "...among the Blackfeet a buffalo robe took the place of the beaver skin ... " (1913:280).

To the south the rich beaver preserve of the Blackfeet Country on the upper waters of the Missouri was again penetrated by American traders. However, as before, these lands were still fiercely protected by the tribes. In 1821 a reorganized Missouri Fur Company sent an expedition up the Yellowstone River which was attacked by the Blackfeet, resulting in the death of seven whites and the loss of their property. In 1822, the Rocky Mountain Fur Company met with a similar fate and abandoned the area (Ewers 1958:54). The Blackfeet were particularly hostile to the white trappers of the mountain regions. According to Ewers:

> Through the remaining years of the twenties and the thirties war parties of Blackfeet and Gros Ventres ranged far and wide on both sides of the Rockies south of the Three Forks. Repeatedly, they attacked the mountain men in their isolated camps or on the trail (1958:55).

A foothold was finally gained in Blackfoot country in 1831. Kenneth McKenzie of the American Fur Company, through the help of an old trapper named Berger, established contacts with the Piegan, who agreed to let him build a fort in their territories. These negotiations were successful because the agreement stipulated that the Indians themselves would collect the furs, and bring them to the fort. As the Blackfeet chiefs told Sanford, an Indian agent, "if you will send Traders into our Country we will protect them & treat them well; but for your Trappers-Never" (in Abel 1932:253).

In the fall of 1831, Fort Piegan was built in the angle between the Missouri and Marias Rivers (Fig. 11). During the first ten days after the fort was built, two thousand and four hundred beaver skins were traded (Chittenden 1954:335). The Piegan capitulation was a major break in the long-standing policy against the presence of traders in Blackfoot territories. Apparently not all members of the Confederacy were in accord with this agreement. That winter, a large force of Blood Indians besieged the fort intent on destroying it, and taking the furs that had been traded by the Piegan. They eventually withdrew. Shortly after this event the Blood again appeared at the fort, implicating the Hudson's Bay Company as the instigators of the attack. At this same time they brought three thousand buffalo robes for trade, as the Canadian traders would not accept them, being too heavy for transport (Ewers 1958:58). If the attack had been for economic gain as implied, it was a rather futile effort. The Blood were not beaver trappers; thus they were dependent on the American posts for the sale of their main trade item, buffalo robes.

The event just discussed marked the beginning of intra-tribal dissension within the Blackfoot nation. While at Fort McKenzie, Maxmillian observed the Piegan firing on the Blood. In addition he notes that, "...we saw in the fort the wife of the chief of the Blood Indians,... who much regretted the misunderstanding that had arisen between the Piekanns [Piegan] and her tribe" (in Thwaites 1906:159). By treating the Piegan preferentially, the trading companies, both American and British, also encouraged dissension between the three groups (Lewis 1942:32).

When the traders abandoned Fort Piegan during the summer of 1832, it was burned down. Later in the same summer a new post, Fort McKenzie, was established in the vicinity (Fig. 11). Its completion marked a permanent foothold in Blackfoot country (Chittenden 1954:335-336). The attacks on beaver hunters continued; however, it appears that the Blood and Blackfoot Proper were now the main antagonists. While at Fort McKenzie in 1833, Maxmillian noted:

> They are always dangerous to white men who are hunting singly in the mountains, especially to the beaver hunters, and kill them whenever they fall into their hands; hence the armed troops of the traders keep up a continual war with them. It was said that in the year 1832 they shot fifty-eight Whites,... . In the neighbourhood of the forts they keep the peace, and the Piekanns, in particular, behave well and amicably to the Whites, whereas the Blood Indians and the Siksekai [Blackfoot Proper] can never be trusted (in Thwaites 1906:96).

According to Ewers, "In 1837, Alfred Jacob Miller reckoned the beaver trappers' losses averaged forty or fifty men a season, Blackfoot losses may have been even greater" (1958:55). Later in 1834, Maxmillian (in Thwaites 1906:164) was dissuaded from going farther up the Missouri for the same reasons: that the Blood and Blackfoot Proper were dangerous. Maxmillian's (in Thwaites 1906:165) narrative indicates that animosities also developed between the Blackfoot Proper and the Piegans.

After the 1840s the provision market changed again. In the forested regions, game animals continued to decline so that the company's pemmican needs increased. The departments of the Saskatchewan were unable to meet these demands because of the southerly and southwesterly contraction of the bison range (Ray 1976:210). The contraction of the bison range was such that the remaining herds were gradually shifting into Blackfeet territories and abandoning areas inhabited by other groups. The Blackfeet had always occupied choice buffalo country. As a result, according to Morton (1927:107), there was constant encroachment from other tribes; so that the Blackfeet were virtually always at war.

The establishment of the American trading posts, the southern contraction of the bison range, and the increasing importance of the buffalo robe and hide trade were some of the events that strongly influenced the movements of the Indian groups during this time period. The Assiniboine, who had been centred in the middle Assiniboine and Qu'Appelle Valleys, began moving towards the international boundary. The Cree moved into the areas vacated by the Assiniboine (Ray 1976:182-3). Ewers (1958:64) also found that the establishment of trading relationships with the American posts on the Missouri strongly influenced a southern shift of the Blackfeet tribes, especially the Piegan. He also observed that the Blood and Northern Blackfeet now wintered north of the international line on the Belly River, and summered on the Saskatchewan.

After 1870 the buffalo trade shifted from robes to hides. This new alternative continued to provide a market for the Plains Indians. The nature of this trade, however, meant that the Indians faced severe competition from the white hunters, since it required little skill, as compared to preparing a buffalo robe, to make the hides ready for trade. These increased hunting pressures played a major role in bringing about the final destruction of the northern bison herds (Ray 1976:212). Some time before the final disappearance of the herds (in the 1880s), the main bison range had contracted to territories lying to the southwest beyond the Cypress Hills (Ray 1976:213). Therefore, what remained of the former vast herds was centred in the heart of Blackfeet territory. This area also coincides, to a large degree, with the former bison summer range which at contact had been commonly shared by all the indigenous groups. By the end of the historic period, this would be the most fiercely protected and fought-over area in the western interior. Father DeSmet, while stationed with the Oregon Missions, from 1845 to 1846, prophetically noted:

> It is highly probable that the Black-Feet plains, from the Sascatshawin to the Yellow-Stone, will be the last resort of the wild animals twelve years hence. Will these be sufficient to feed and clothe the hundred thousand inhabitants of these western wilds? The Crees, Black-Feet, Assiniboins, Crows, Snakes, Rickaries, and Sioux, will then come together and fight their bloody battles on these

> plains, and become themselves extinct over the last buffalo-steak (1978:334)

It took somewhat longer then 12 years but by 1868, Cowie at Fort Qu'Appelle observed that the scarcity of bison was forcing the Indians to encroach on Blackfoot territories. Groups usually at odds with each other were uniting to have sufficient numbers "to penetrate farther into the enemies' country". He identifies the groups gathering to go to war against the Blackfeet as follows:

> So it had come about that the allied Crees and Saulteaux, the semi-Stony and Cree "Young Dogs", of Qu'Appelle and Touchwood Hills, a few English and French Metis belonging to these places and Fort Pelly, also some Assiniboines from Wood Mountain and a few from the North Saskatchewan, were all gathered together in a camp ... containing a mixed population of probably two thousand five hundred or three thousand people, of whom about five hundred were men and lads capable of waging war (Cowie 1913:302).

By the early 1870s many Indian groups in southern Saskatchewan and Alberta had come to realize that their traditional way of life was coming to an end. Between 1871 and 1876 all Indian territorial claims were extinguished by Treaties 1 through 7 (Ray 1976:228). The bison hunting tradition, which prior to contact with the white men had persisted for thousands of years, was gone.

In summary, direct trading between the Plains groups and the fur traders brought into focus the fact that the Plains Indians were not beaver hunters. Within the fur trade structure a relative status system between these groups was developed, based on beaver hunting versus non-beaver hunting: the beaver hunters were given preferential treatment. For the Blackfoot, increasing tribal animosities with the Cree and Assiniboine, and the arming of the Kutenai and Salish, placed a premium on the possession of guns and ammunition. Because they traded in less valuable furs, the Piegan and Gros Ventre were unable to buy a sufficient supply of armaments. These conditions not only led to these tribes suffering military defeats, but territorial realignments occurred that were to their disadvantage. The early nineteenth century witnessed the first break in the long-standing policy of the Blackfoot tribes not to allow traders in their country. The Piegan, who also had begun to trap beaver, allowed a fort to be built in their country on the stipulation that they themselves would collect the furs. By this time some infractions of the prohibition against beaver hunting were beginning to occur among the Blood. However, there is no evidence in the historic record that the Blackfoot proper, Gros Ventre, or Plains Assiniboine ever actively participated in the trapping of beaver.

THE EFFECT OF THE FUR TRADE ON THE AVERSION TO BEAVER HUNTING

The aversion to beaver hunting reached its highest expression in the groups who entered the Plains as a pedestrian peoples: the Blackfoot tribes (Piegan, Blood, and Blackfoot Proper); the Gros Ventre; and the Plains Assiniboine. The evidence regarding the Cree is not conclusive. Some Cree were on the Plains at contact, and probably were not hunters of beaver. The main body moved on the Plains at a later date, after the acquisition of the horse, and appeared to be been in an intermediate phase, exhibiting both Woodlands and Plains traits.

Within the Blackfoot tribes, the Piegan exhibited the most pronounced breakdown of the prohibition, while the other members generally continued the prohibition. As late as 1834 Maxmillian noted:

> The proper Blackfeet (Siksekai) and the Blood Indians catch but few beavers, being engaged in war parties, and especially selling meat to the Hudson's Bay Company. The Piekanns, on the other hand, catch the most beaver. Beaver traps (which are lent them) were distributed among them to-day, and many Indians went away to hunt beavers (in Thwaites 1906:162).

The historical record, however, indicates that by 1810 individual infractions of the prohibition against beaver hunting were already occurring among the Blood. At Rocky Mountain House, Henry made several references to the Blood bringing beaver to the fort for trade (in Coues 1965:643-665). However, there does not appear to be any evidence that the Northern Blackfoot ever participated in the beaver trade. They were first involved in the trade of less valuable furs such as wolves and foxes, as well as horses. Later, they were major participants in the provisions market; and when the trade in buffalo robes replaced the provisions market, they became important suppliers of this commodity.

The Gros Ventre also were not beaver hunters, and continued as such during the historic period. In 1810, at Rocky Mountain House, where both Blood and Piegan were trading beaver pelts, the Gros Ventre traded only in horses and wolves (Henry, in Coues 1965:657-671). Chardon's journal (in Abel 1932:78-102) indicates that even at this later date (1834-1839), the Gros Ventres' main item of trade was buffalo robes. Chardon infrequently mentions the Gros Ventre bringing a few beaver pelts to the fort for trade; however, these observations are problematic. The Gros Ventre were particularly infamous for attacking beaver trappers and using their furs as trade items. As Chittenden notes:

> The Grosventres of the Prairies,...were the most relentlessly hostile tribe ever encountered by the whites in any part of the West, if not in any part of America, and the trapper always understood that to meet with one of these Indians, meant instant and deadly hostility (1954:852).

Apparently these attacks on white trappers were continuing, as Chardon notes:

> ...traded a few Beaver skins from the Gros Ventres, (marked M.C.). No doubt they have Kill'd and pillaged Old Carriere, who was hunting on Powder river (in Abel 1932:85).

Unfortunately Chardon does not often distinguish the method by which the beaver pelts brought to the fort were procured, so that the extent of actual beaver trapping by the Gros Ventre is indeterminate.

The historical record does not appear to suggest that, during the fur trade era, the Plains-oriented Assiniboine ever hunted beaver. Lewis and Clark, while travelling on the Missouri in 1805, noted that, "The principal inducement with the British fur companies, for continuing their establishments on the Assiniboine river, is the Buffaloe meat, and grease they procure from the Assiniboins, and Christanoes [Cree]..." (in Thwaites 1969:306). Mackenzie goes so far as to suggest that the non-hunting of beaver may have affected Assiniboine settlement patterns. He states that the Assiniboine and Fall Indians occupied the central part of the Assiniboine River, while the Algonquins and Cree occupied the source and the area near Lake Winnipeg. He states that, "They [Assiniboine] are not beaver hunters, which accounts for their allowing the division just mentioned, as the lower and upper parts of this river have those animals, which are not found in the intermediate district" (1802:45).

The evidence on the Cree is more clouded. Major movements onto the Saskatchewan Plains took place mainly during the historic period; and many of these Cree groups were exhibiting both Woodlands and Plains traits. Also by the time the majority of the Cree became permanent inhabitants of the Saskatchewan Plains, most of the beaver had been trapped out.

With regard to the Sarsi, Henry (in Coues 1965:737) had implied that when they came in contact with the Blackfoot tribes they appeared to develop a reluctance to beaver hunting. This behavior may reflect an adherence to Blackfoot policy: that friendly groups could trap in Blackfoot territories to the extent that it covered their subsistence needs. The Sarsi never settled on the Plains, remaining in wooded areas such as the Beaver Hills and near the mountains. At Rocky Mountain House the Sarsi were major suppliers of beaver pelts (in Coues 1965:649-659).

What were the factors that brought about the erosion of the aversion against beaver hunting? Economic pressures - the need for guns and ammunition - were probably one of the most significant, particularly for the frontier tribes, the Piegan and Gros Ventre. In many ways it is understandable that the Piegan would exhibit the most pronounced breakdown of the prohibition. First, the adherence to the aversion was not as strong as the other Blackfoot tribes; there was a small group of Woodland Piegan in the Rockies that had always hunted beaver. The arming of their enemies (the Kutenai, Flathead, and Nez Perce) on the southwestern borders, plus the increasing violations of their American territories in the early nineteenth century by white trappers and American fur companies, placed a premium on the need for armaments. Also the American fur companies were in the position to apply economic pressures on the Piegan. The provisions market was in decline; and the buffalo robe, which only the American companies would accept, was the main trade item of the Piegan. Faced with these problems the Piegan allowed the American Fur Trade Company to establish a post in their territories based on the agreement that the Indians themselves would collect the beaver pelts. It seems that the Piegan decided that if the beaver were to be trapped, they may as well be the trappers and reap the benefits.

Interestingly, the Gros Ventre were also a frontier tribe, bearing the brunt of the Assiniboine and Cree advances into the Plains, during the early period of the fur trade. Their defeats were attributed to their inferiority in arms, which was generally accepted as being the result of their not having a market for their less valuable furs. However, for the most part, they resisted becoming involved in beaver trapping, gaining many of their beaver pelts through pillage.

Economic pressures also contributed to the breakdown of the prohibition among the Blood. At Rocky Mountain House, Henry observed that, "Two Blood and their families brought in 14 fresh beavers-the meat, but no skins; these they preserve to enhance the value of the wolves they may kill this winter" (in Coues 1965:663).

Another factor that contributed strongly to the erosion of the aversion to beaver hunting was the addictive nature of alcohol, which was used as a means to compel the Indians to hunt fur-bearing animals. As McGillivray notes:

> The love of Rum is their first inducement to industry; they undergo every hardship and fatigue to procure a Skinful of this delicious beverage, and when a Nation becomes addicted to drinking, it affords a strong presumption that they will soon become excellent hunters (in Morton 1929:47).

Chittenden, commenting on the attack on Fort Piegan by the Blood which was repulsed by Kipp, the fur trader in charge, also stressed the use of alcohol as a means to force the Indians into submission. He states:

> Kipp then turned his own weapons of war - the war of the traders - upon the Indians, and poured into them incessant charges of alcohol until the whole band was utterly vanquished and surrendered body and soul to the incomparable trader (1954:335).

Of equal significance was the fact that the ecological basis of the non-use of beaver resources was weakened. It may be inferred that prior to contact, the pedestrian peoples of the Plains had drawn on their ecological knowledge to secure water resources through the non-use of beaver populations. They had also learned to manipulate the bison herds directly or indirectly through the use of fire. Knowledge of bison behavior also led to the development of non-disruptive hunting techniques. These strategies allowed for the prolonged and repetitive use of their residential bases, the most important being the wintering areas in the Valley Complex systems. Given these conditions the early Plains occupants were then able to become familiar with these areas; that is, they were able to determine the spatial and quantitative allocation of resources on a more localized or specific level. This information is particularly important in the Valley Complex, which is characterized by its pronounced microclimatic variability. During drought this knowledge could be critical. Familiarity with an area, especially when moving along the migration corridors, would provide the knowledge as to which beaver ponds still retained water.

The acquisition of the horse and its consequences significantly altered the previous pedestrian lifeways. First, the greater mobility of the horse allowed for a wider range of resource exploitation so that dependency on a specific geographic area was not as crucial. Dodge's observations confirm that the mobility of the horse provided choices in the selection of a wintering area:

> Experienced warriors have been sent to all the streams, most loved by the tribe, and to make a thorough examination of all the country. When all have returned a council is held...,they are closely questioned as to shelter, wood, water, and grass or cottonwood for the ponies (1959:242)

Second, the chase on horseback, and horse-raiding parties, seriously disrupted bison movements, so that there was no guarantee that the herds would return to specific areas, or remain. Finally, the mobility of the horse placed the tribal groups within striking distance of each other. This factor combined with intensifying warfare placed a premium on mobility. Frequent changes in the residential base may have been necessary for safety.

The use of fire as an economic weapon was also disrupting bison movement patterns. According to McGillivray, at Fort George "The Indians often use this method [fire] to frighten away the animals in order to enhance the value of their own provisions" (in Morton 1929:33).

Although the horse was a major cause of the marked changes that occurred in this historic period, its mobility in turn provided a solution. From a regional perspective, on the Plains the destruction of the beaver populations must have severely reduced the amount of surface water that was available, and limited its geographic distribution to the larger waterways. Again, the horse's mobility would have compensated for these changes. Perhaps more important, the destruction of the beaver removed it from the ecological dynamics of the Plains ecosystem. It was no longer central to the ecological knowledge of the Plains groups, and remained important only within the ideological dimension.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The advent of the fur trade, particularly with the subsequent establishment of direct trading, brought sharply into focus the fact that the Plains Indians were not beaver hunters. Neither the enticement of trade goods nor pressures from the fur traders could induce them to engage in the profits that attracted other Indian groups.

The main hypothesis put forth in this study has been that the aversion to beaver hunting, by the Plains occupants was both a response to the limited availability of surface water and a recognition of the beaver's role in maintaining these resources in the Valley Complex (river/stream) systems. Contributing factors to the non-use of beaver resources are the animal's limited distribution, (to only a few micro-habitats), and low populations combined with their highly visible and stationary lifestyle (making them susceptible to human overkill). An underlying premise in this study has been that hunter/gatherers are necessarily aware of basic ecological relationships; and that these forms of knowledge are an important part of resource procurement strategies.

However it was also observed that within a Valley Complex network, resource distribution is not uniform, in particular with regards to surface water supplies. Differences in the availability of surface water are most commonly related to the size of the waterway. This factor, combined with the spatial relationships between essential resources, i.e., proximity of surface water to treed areas and shelter, results in certain areas, specifically the large tributaries, providing more favourable habitat conditions for human and/or beaver populations. The historical record indicates that the historic Plains tribes preferred the valleys of the larger tributaries for their winter camp sites.

Given the above, the following hypotheses were put forth:

(1) Because of the storehouse effect of the beaver dam/pond systems, most surface water resources in the tributaries, particularly during drought, are restricted mainly to beaver-

occupied areas.

(2) In the Valley Complex system the most favourable ecological conditions for winter habitation, i.e., those having adequate surface water in proximity to treed areas, are most frequently found in the large tributaries. In terms of the archaeological perspective, large winter campsites, and pounds should have the greatest frequency in the area.

(3) In small/medium-sized tributaries, where treed areas and surface water are even more frequently in close proximity to each other, limited surface water, particularly during drought, would have prevented most areas from being used with any degree of permanency by human or beaver populations. The archaeological record should reflect these instabilities, with the result that temporary campsites are the most common site type in such areas.

(4) In main waterways, due to the considerable extent of the floodplains, inaccessibility to treed areas would generally have acted against their suitability as wintering areas for human populations. In contrast, the main waterway, because of the greater stability of its water resources, would have been an important wintering area (perhaps crucial during drought) for beaver populations. The archaeological record should again indicate temporary campsites as a major site type in the area. As the main rivers are a seasonal source of supplementary food resources, (e.g., fish), special purpose sites, reflecting seasonality, should also be found.

Within the Qu'Appelle Valley Complex of southern Saskatchewan, several research areas were selected to test the above hypotheses: Cottonwood Creek (a small/medium-sized tributary), Moose Jaw River and Wascana Creek (large tributaries), and the Qu'Appelle River (the main waterway). To provide a more specific definition of the contrasts and similarities between Woodlands and Plains ecosystems, and the resulting effects on man/animal relationships, in particular beaver, ecological studies were also carried out in Elk Island national Park, which is categorized as part of the Parkland-Boreal Forest transition zone.

THE REGIONAL SETTING: THE PLAINS

On the Canadian Plains surface water and treed areas are restricted mainly to the Qu'Appelle and Saskatchewan Valley Complex systems and shallow saline sloughs. Soil moisture, effected mainly by precipitation, is the limiting factor to plant growth. From a focal point in the Xeric Mixed Prairie, in southwestern Saskatchewan and southeastern Alberta, a gradient of increasing moisture effectiveness (higher precipitation, lower temperatures,the shading effect of trees) radiates west, north and east to the Aspen Grove Region, and beyond to the Boreal Forest. In these northern areas more favourable moisture conditions are expressed in a predominance of treed areas,and numerous lakes and rivers. The result of these ecological dynamics on the Plains is an arched geographic placement of major grassland communities around a central area or core--the Xeric Mixed Prairie.

It was found that the bison summer range generally corresponds to the area associated with the Xeric Mixed Prairie, while the bison winter range corresponds to the vegetative communities along its peripheries: the Mesic Mixed Prairie and the Fescue Prairie and transitional grasslands of the Aspen Grove Region.

TRADITIONAL MAN/ANIMAL RELATIONSHIPS: THE PLAINS

The theoretical model stresses the importance of the bison herds in the subsistence strategies of the early Plains peoples. Consequently the movement patterns of these groups were strongly correlated with the migrations of the herds. However, within the man/bison annual cycle, the availability of surface water was critical limiting factor influencing not only more specific and/or localized movements but the location of residential bases.

It was also proposed that basic habitat requirements for both beaver and human populations were similar: sufficient surface water in proximity to treed areas. To the beaver treed areas were necessary for food and construction materials; to humans trees provided shelter and firewood. These basic resources were appreciably enhanced directly and indirectly by the presence of beaver. Beaver not only conserve and maintain surface water, but by felling tree/shrub species they also provide dry firewood. and construction materials. Beaver dam/pond systems also attract a range of faunal forms which serve as alternate food resources. Parallel needs placed humans and beaver in close association; the conservation rather than exploitation of beaver thus greatly benefited the early Plains occupants. Ethnographic studies, and the historical record suggested that the larger tributaries provided the most favourable wintering areas for the early Plains peoples. Ecological studies similarly imply that suitable beaver habitat was most frequently found on large tributaries.

The Plains peoples' understanding of broad ecological patterns, such as the beaver's abilities to stabilize surface water, and the nature of bison migrations, allowed for the repetitive use of areas. They were then able to become familiar with these areas; that is, to assess more precisely the spatial distribution and abundance of resources. This knowledge is particularly important in the Valley Complex, in which microclimatic variability is pronounced; the distribution and abundance of surface water is particularly uneven and subject to marked fluctuations seasonally and from year to year. Once a suitable wintering area was selected, they were able to remain relatively sedentary throughout the winter. The length of stay in wintering areas. was estimated at approximately seven months. Environmental knowledge, in this case an understanding of more specific bison behaviour, contributed to the prolonged occupation. They developed hunting techniques (pounds and jumps) that permitted them to manipulate the herds to the kill area with a minimum of disruption. Herds remained in the vicinity of the winter settlements where they could be subsequently hunted, an important advantage for pedestrian peoples during the severest winter conditions.

In spring the bison herds vacated the sheltered areas and scattered over the prairies, lured by the emergence of new spring grasses on the uplands. An understanding of environmental phenomena again provided the Plains occupants with the means to deal with the dispersal of the herds. The prescribed burning of grasslands acted so to concentrate the herds in preselected areas near their camps. They were thus able to continue their communal hunting until the majority of the bison moved to the summer range. Similarly, these burned areas continued to attract herds in the fall, greatly facilitating their hunting at that time of year. This situation particularly points to the advantage of being able to return to specific areas. Herds on the summer range would have continued to be dispersed and mobile. Once more, through the use of prescribed fire, they could have maintained the herds in strategic areas,i.e., in proximity to water and treed areas. These areas would be fired just prior to the return to the winter range.

By fall surface water would have been restricted mainly to the river/stream systems; thus the smaller tributaries would serve as migration corridors as the groups moved down the valley systems to their wintering areas in the large tributaries. The importance of beaver in maintaining surface water becomes especially evident in fall. In a small tributary surface water would be mostly restricted to beaver-occupied areas. These areas would not only provide crucial water, but herbivores such as elk and deer would have been drawn to these areas by the availability of superior forage.

During a drought cycle marked changes occur in the Plains environment. In the broadest sense these are predictable, and known to the residents. During the initial stages of drought (the first two years) there are progressive declines in surface water, with water loss most pronounced in small tributaries. As the Plains groups moved along the migration corridors to the winter range, the spatial allocations of the remaining surface water would have been crucial information to a peoples with limited mobility. At the height of a drought, winters are usually dry, so that spring runoff would be negligible. Most small tributaries become dry stream beds, infrequently dotted by isolated beaver ponds. By this time bison populations would have experienced high mortality rates. Because of the unavailability of surface water, both human and bison populations would have suspended movements to the summer range. Some areas on the large tributaries would become dry, but the evidence points to most beaver-occupied areas being able to withstand the drought; as a result most wintering sites would not have been affected. The assumption is again made that being familiar with the area, the Plains groups would have occupied the most suitable wintering sites. During drought many animals, including beaver and large ungulates, would have been drawn to the main waterway because essential resources (water and forage) would be concentrated there. At this time there would be a marked drop in water levels, and stream flow would be reduced. Beaver would have been forced to began constructing dam/pond systems to maintain a sufficient amount of water, again contributing to the maintenance of a scarce resource. The Plains groups would have been similarly drawn to these areas, from spring to late fall, to pound the bison off the valley slopes. With winter freezeup they would have returned to their winter camps in the larger tributaries.

In summary, by using environmental knowledge as an important part of their hunting and gathering strategies, the Plains occupants were able to remain relatively sedentary during most of their annual cycle, an important survival factor for a peoples with limited mobility. Again the importance of the beaver to the Plains occupants must be emphasized: without beaver the Plains would have been an inhospitable place, particularly during drought.

During drought these oases of water and greenery in a parched landscape, with their focal beaver lodge, must have impacted strongly on the Plains occupants. However, because surface water was limited, consequently so were suitable beaver habitats. Low populations combined with a highly visible and stationary lifestyle resulted in beaver being highly susceptible to human predation. The possibility therefore existed that even limited hunting could potentially disrupt the critical relationship between beaver and the availability of surface water. The beaver thus had to be protected. Supernatural control was invoked through the mechanisms of myth, ritual and ceremonies. Plains Indian myths particularly imply adverse repercussions if beaver were harmed, or supernatural benevolence if beaver were protected. The above dynamics underlie the aversion to beaver hunting that was brought strongly into focus during the advent of the fur trade.

The Ecological Evidence

One of the major characteristics of the Valley Complex is pronounced microclimatic variability, which is expressed in a wide range of habitats. Spring runoff, originating mainly from snowmelt, is the major source of surface water in the waterways; moisture from summer precipitation is normally lost to evaporation. There is a general pattern of high water levels in spring, progressively dropping to low levels in fall. There are also marked variations in surface water availability on a year to year basis. These fluctuations reach their greatest intensities on a small waterway because surface water is less abundant than in larger waterways. These differences in surface water availability affect beaver behaviour.

On a small tributary beaver are forced to build elaborate primary and secondary dam/pond systems to maintain a sufficient amount of water. Primary dam/pond units, which contain the lodge, are deliberately deepened and widened to provide accessibility to the food cache in winter. Because they are deep, and regulated by the secondary dam/pond units, these primary ponds are highly resistant to evaporation. The structural nature of primary dams, being highly compact and triangular in cross section, contributes to the maintenance of surface water in the associated pond; as water levels drop correspondingly the dam becomes more impermeable.

On a small tributary suitable beaver habitat is restricted to a specific spatial configuration; i.e., when the waterway is in proximity to a treed northern exposure slope, and water resources are of sufficient quantity so that beaver, through the construction of their dam/pond, can effectively maintain the depth and extent necessary for dwellings and access to food caches. This spatial configuration also indirectly contributes to increased surface water availability. Snow capture by treed slopes provides additional amounts of surface water to the associated beaver ponds. Breaks (e.g., coulees) in the valley wall, which collect snow and precipitation, also contribute significantly to the abundance of surface water in the associated ponds. During the intense drought of the late 1980s the beaver dam/pond systems associated with breaks in the valley wall exhibited the greatest resilience (remained viable) to the effects of drought. All the above factors point to the importance of beaver dam/pond systems in conserving and maintaining surface water in the Valley Complex systems. It is proposed that this knowledge of this essential relationship between beaver and the availability of surface water was a crucial subsistence strategy for the early pedestrian peoples of the Plains.

However by fall, even under normal climatic conditions, surface water in a small tributary is generally restricted to these beaver-occupied areas. In addition, beaver occupied areas are not equally endowed with surface water resources. On any one tributary, the abundance of surface water in the various beaver occupied areas varies significantly; by fall some ponds become dry, while others contract markedly, but still retain appreciable amounts of water. These conditions intensify during drought. The tributary becomes mainly a dry stream bed dotted infrequently by isolated primary dam/pond units containing the lodge, often abandoned. Most beaver colonies are forced to abandon the area permanently. Therefore the repetitive use of specific areas, ma[illegible] possible by their awareness of ecological systemics, was another important strategy for pedestrian peoples, providing them the essential information on the spatial allocations of the remaining viable beaver dam/pond systems.

On a large tributary, because surface water is significantly more abundant, beaver dams are open during most of the season. In early fall, beaver close the dams and surface water is regulated. Stream flow generally is continuous during the entire vegetative season. As a result, although treed areas are most abundant on northern exposure slopes, they also tend to fringe the waterway more continuously. The beaver still exhibit the habitat preference established for a smaller tributary; but there are other habitats, perhaps not as suitable, which are also occupied. Beaver populations reach their highest densities on a large tributary. Because of this greater spectrum of suitable habitats beaver dam/pond networks are more extensive, correspondingly regulating and maintaining a broader area of surface water resources. This greater stability is reflected during the drought. Small sections of the waterway became dry, however, most beaver dam/pond systems continued to be viable, but generally of reduced extent. Beaver movements were localized. . The ecological evidence clearly supports the proposition that suitable habitats for humans and/or beaver reach their highest frequencies on large tributaries.

On the main waterway surface water reaches its greatest abundance. Strong stream flow acts against dam or lodge construction. Beaver contribute little to the direct maintenance of surface water; but beaver populations that are regulating stream flow in the tributaries, indirectly contribute to the continued flow in the main waterway. Food resources are limited in the main valley because the flood plain is extremely broad, and the waterway tends to be positioned centrally, making most treed slopes generally inaccessible. Beaver populations thus are low. It can also be assumed that, because of the spatial incongruity between surface water and shelter, suitable habitat for human populations would only be infrequently met.

The primary hypothesis also stated that contributing factors to the non-use of beaver were their low populations, and a highly visible, stationary lifestyle, making them highly susceptible to overkill. On the Canadian Plains beaver populations are mainly restricted to the Valley Complex systems. Within these systems, beaver habitat is further restricted: on the main waterway a scarcity of food limits population size, while on small tributaries an insufficiency of surface water is the limiting factor. Beaver reach their highest densities in large tributaries. During drought, beaver populations on Cottonwood Creek (a small tributary) were reduced to 0.13 colonies/river km. On the plains beaver not only are restricted to select areas, but their populations are low.

TRADITIONAL MAN/ANIMAL RELATIONSHIPS: THE WOODLANDS

Compared to the Plains occupants, Woodlands groups used a greater variety of food resources. Several large game animals were hunted. The moose, was the most important but, unlike the bison, its was dispersed and hunted only seasonally, in winter. Through the use of prescribed fire, the Woodlands peoples created browse and graze areas, which attracted and concentrated the large game animals. Equally important, they manipulating these animals to areas that they were aware of, in order to facilitate hunting.

The beaver was also an important food source and, prior to contact, was probably hunted mostly in spring and fall. The simplest way to hunt beaver during more temperate conditions was by breaking the dams and draining the ponds. Because beaver hunting techniques in winter were highly labour intensive, and a good return was not often predictable, they were carried out mainly when large game was scarce. During the historical period, the emphasis on beaver hunting in winter,during the historic, was related to the fact that its pelt was most valuable in winter.

These traditional hunting techniques continued to be used with little modification well into the historic period. The historical record clearly showed that the traditional hunting techniques could have a significant impact on beaver populations. Long before the introduction of the steel trap beaver populations in many northern areas had been destroyed, or significantly reduced. These events did not occur in earlier times because the demands on beaver, mainly as food (furs were always a surplus), did not exceed supply. It is during the historic period that fur needs, to procure trade items that were becoming essential, exceeded food needs and supply, setting the stage for the destruction of the beaver. The historical record also indicates that beaver populations were high prior to the advent of the fur trade. In fact the Woodland Indians may have been faced with an over-abundance of beaver, and the effects of their activities:the innundation of browse/grass areas that were important food sources for the large game animals, consequently resulting in their dispersal.

Through their knowledge of animal behaviour and fire ecology, they were able to come up with a solution. They created beaver meadows that not only provided grassland areas for large herbivores, but also were an effective way to control beaver. The breaking of beaver dams and draining of the ponds actually served a dual purpose: (a) it was an effective technique for beaver hunting; and (b) it provided the initial phase in the creation of a beaver meadow. Beaver meadows have special attributes that facilitate maintenance. Their soils are toxic to tree/shrub species; the inhibiting effect lasting up to ten years. The first species to invade the meadows are important browse species such as willow and alder. To prevent beaver from reoccupying an area, it would be only necessary to fire the peripheries of the meadow once every three or four years to prevent new growth of aspen.

The Ecological Evidence

Research in Elk Island National Park has provided a general picture of the environmental features of a Woodlands biome. In marked contrast to the Plains, treed areas (mainly *Populus spp.*), and aquatic environments (slough, lake and intermittent stream) dominate the landscape. Also, unlike the Plains, water levels rarely fluctuate during the vegetative season, and may actually rise in fall. Although the initial impression would be that the beaver play an important role in opening up grassland areas in the forest. to the contrary, the amount of grass/browse areas inundated markedly exceeds the amount of area opened up by beaver activities. In other words, beaver -induced flooding has appreciable reduced the food resources of ungulates.

In the park beaver populations also are high; in 1988 the density was 1.60 active lodges /km squared. From 1942 to the present, an exponential growth in beaver populations has occurred. Other Woodlands areas have exhibited similar marked increases in beaver populations. The above conditions can be attributed to several factors: the control of natural fires; beaver have few natural predators; and the discontinuance of traditional burning practices by aboriginal peoples.

COMPARISON BETWEEN WOODLANDS AND PLAINS

Several broad parallels can be drawn between the Plains and Woodlands groups. Environmental knowledge was fundamentally important in hunting and gathering practices. Since both groups tended to return to specific areas during their annual life cycle, knowledge of fire ecology and animal behaviour was used to manipulate large game animals to the vicinity of their residential areas, thus facilitating hunting and prolonging the duration of stay. Prescribed firing, however, was more important among the Woodlands groups, as it served, not only to attract game animals, but to create new habitats (open grassland /shrub areas) for them. On the Plains, beaver occupied areas served much the same purpose, attracting game animals because of water and superior forage. It was in their relationships to beaver that major differences relating to environmental conditions occurred. On the Plains, beaver activities, (the construction of dam/pond systems) resulted in the maintenance of surface water (a limited resource), mainly within the physical parameters of the waterway-flooding was not common. Because beaver were not abundant, the Plains groups refrained from hunting them. In the Woodlands beaver were abundant and an important source of food. However, these same beaver activities generally resulted in flooding which, from the perspective of the natives, had a detrimental effect on the environment. Important browse/graze areas were destroyed reducing not only the food supply of game animals, but effectively dispersing them. Through the creation of beaver meadows, and the use of prescribed fire, the Woodlands peoples were able simultaneously to controlled the beaver populations, created additional food resources for the game animals, and concentrated them into strategic areas for hunting.

THE HISTORICAL EVIDENCE

During the early contact period observations by fur traders such, as Henday and Cocking confirmed the non-use of beaver by the Plains groups. The Blackfoot tribes and the Gros Ventre traded in less valuable furs (wolves and foxes), horses, and buffalo skin garments in exchange for metal goods and guns. There also appeared to be some Cree on the Plains exhibiting Plains traits such as pounding bison and hunting wolves. As early as the beginning of the eighteenth century, the Plains Assiniboine were already identified as not being beaver hunters. Some of the plains oriented traits that had developed by this time included: (a) the abandonment of the can[illegible], (b) the non-hunting of beaver; (c) a primary reliance on the bison for subsistence; and (d) the development of communal bison hunting techniques,(jumps and pounds).

The critical evidence supporting the theoretical model is that the non-hunting of beaver was exhibited by aboriginal peoples which had entered the Plains as pedestrian peoples: the Blackfoot tribes (Blood, Piegan and Blackfoot Proper), the Gros Ventre, the Plains Assiniboine and small groups of Cree.

THE ARCHAEOLOGICAL EVIDENCE

An archaeological survey was carried out on the Wascana Creek (a large tributary) and its tributary the Cottonwood Creek(a small/medium-sized tributary to test the specific hypotheses relating to human settlement patterns. It was proposed that if the large tributary provided the most suitable ecological conditions for wintering areas then large winter campsites should reach their highest frequencies in this area. Of the 15 sites designated as winter campsites on the above combined tributaries, whose survey areas were of comparable extent, 13 (87%) were located on the Wascana Creek. It was also proposed that surface water limitations would prevent prevent most areas on a small tributary from being used with any degree of permanency. Temporary campsites should be the most the most common site type in the area. It was found that 10 (66%) of the 15 designated sites were temporary campsites. It was also predicted that on the main waterway inaccessibility to treed areas (shelter), due to the considerable extent of the flood plain, would generally act against its suitability as a wintering area. Out of 74 recognized sites in the area, only 2 (3%) were found on the flood plain of the main waterway. One of these was designated as a winter camp, and was located at the confluence of the main waterway with a large tributary. Two other site configurations, indirectly associated with the main waterway, were inferred as possible wintering areas. One was found on the flood plain of a large tributary near its confluence with the main waterway, while the other was located in a coulee entering the main valley. The remaining sites were mainly tipi rings located on the valley slopes and prairie uplands. In the tributaries, winter camps were mostly associated with northern exposure slopes, where the waterway was proximate to, or cut the slope wall: the habitat configuration also recognized as best suited for beaver.

THE HISTORICAL SETTING

In the Historic period direct trading between the Plains groups and the fur traders brought into focus the fact that the Plains Indians were not beaver hunters. This behavioral trait was to markedly affect their role, often to their detriment, in the developing dynamics that characterized the period Within the fur trade structure a status system developed based on beaver hunters versus non-beaver hunters; the beaver hunters, e.g., Woodland Cree and Assiniboine, were given preferential treatment. Prior to this time the Blackfoot tribes and the Gros Ventre were relatively independent of the fur traders, purchasing only luxuries at the post. However, increasing animosities with the Cree and Assiniboine placed a premium on the possession of guns and ammunition. Because the Plains tribes traded in less valuable furs, they were unable to buy a sufficient supply of armaments. The defeat of the Gros Ventre by the Cree was attributed to this factor, and led to their abandonment of the upper Qu'Appelle and lower Saskatchewan valleys. Similarly the newly armed Salish went on the offensive, and the Piegan were forced to retreat, giving up part of the bison range. Because they did not hunt beaver, the Piegan and Gros Ventre, not only suffered military defeat, but territorial realignments occurred that were to their disadvantage. Conditions became even more precarious when the Hudson's Bay Company, not only devalued by half the wolf pelt (a major trade item), but also ordered that as few as possible be purchased. The Plains Assiniboine were in a position to work around this problem by trading horses for guns from their allies, the Cree. The Blackfoot tribes and the Gros Ventre, to some extent, were able to circumvent the prohibition against beaver hunting by confiscated pelts from trappers, and in turn trading them at the posts.

Although the Plains tribes continued to adhere to their policy of not beaver hunting, by the end of the eighteenth century, beaver had been trapped out in many areas. If the Plains Indians did not hunt beaver, then who did ? Blame can be placed on several groups: the Woodland Assiniboine and Cree, and the Sarsi; the Eastern Woodlands Indians, particularly the Iroquois; Free Canadians; and Company Servants.

The early nineteenth century witnessed the first break in the long-standing policy of the Blackfoot tribes not to allow traders in their country. The Piegan, who also had begun to trap beaver, allowed a fort to be build in their country on the stipulation that they themselves would collect the furs. This event also signalled the beginning of animosities between the Piegan and the other members of the Blackfoot tribes (the Blood and Blackfoot proper). By this time some infractions of the prohibition against beaver hunting were beginning to occur among the Blood. There is no evidence in the historic record that the Blackfoot Proper, Gros Ventre, or Plains Assiniboine ever actively participated in the trapping of beaver.

In conclusion, during the historic period the aversion to beaver hunting was mainly exhibited by those groups who entered the Plains as pedestrian peoples: the Blackfoot tribes (Piegan, Blood and Blackfoot Proper); the Gros Ventre; and the Plains Assiniboine. Within these groups its highest expression was witnessed among the Blackfoot tribes, which are generally acknowledged as the earliest inhabitants of the plains. The evidence on the Cree is more equivocal. Some Cree were on the Plain at contact, and gave every indication of being non-beaver hunters. The main body moved onto Plains at a later date, after the acquisition of the horse, and appear to have been in a intermediate phase, exhibiting both Woodlands and Plains traits of trapping beaver and pounding bison.

The developing provisions market eventually provided the Plains tribes with the means to obtain sufficient trade goods including armaments, and gained them some independence from the fur traders. However, with the amalgamation of the two fur trading companies, many men (Metis or Freemen) were released from service who became serious competitors with the Plains Indians for the provisions market. However, by this time the reduction in the provisions market was compensated by a growing market for buffalo robes.

Several factors brought about an erosion of this prohibition against beaver hunting: economic pressures; intensifying tribal animosities; and a dependence upon alcohol which increasingly made the Indians more susceptible to the persuasions of the traders. More specifically several events led to the Piegan decision to allow traders in their country: the arming of their enemies, the Kutenai and Salish; the increasing encroachment on their territories by white trappers and the fur companies; and the need to appease the American Fur Company, which provided the only market for their buffalo robes. Also important was the fact that the environmental basis for the non-use of beaver was weakened with the acquisition of the horse, the consequences of which significantly altered the pedestrian lifeways. Whereas the presence of beaver had been important for securing and maintaining surface water, allowing early Plains occupants to return to specific areas, the greater mobility of the horse allowed for a wider range of resource exploitation. The dependency on a specific geographic area was no longer crucial. In fact, the mobility provided by the horse placed groups within striking distance of each other, and thus put a premium on mobility, with frequent changes in the residential bases being necessary for safety.

In addition, the chase on horse back, horse-raiding parties, and the use of fire as an economic weapon seriously disrupted bison movement patterns. It was no longer possible to predict when the bison would come or what areas they would frequent. Consequent bison drives were discontinued because the chase disrupted the predictable patterns upon which they were based: the movements of herds to specific areas; and the specific herd behaviour that was manipulated to bring the animals to the kill site. Although the presence of the horse and the new hunting techniques that were developed created these uncertainties, the horse's mobility increasingly provided the solution, but further intensified these conditions. The advent of the horse was a major contributing factor to the patterns of nomadism that pervaded the historic period.

FINAL REMARKS: FURTHER TESTING

An important question to be asked, considering the pronounced microclimatic variability associated with the Valley Complex, is how applicable are the research results from the Qu'Appelle basin to other Plains areas. Some of the broader assumptions put forth in this study should be relevant within a wider geographical framework. Perhaps the most important and with the broadest geographic applicability is the assumption that,on the Plains, surface water is limited, and beaver activities are an important factor in stabilizing and maintaining these resources. In addition parallel needs (sufficient surface water in proximity to treed areas) place humans and beaver in close association. In the Valley Complex systems these requirements are most ideally met by a very specific spatial configuration: when a waterway approaches a treed northern exposure slope. It also was observed that this habitat configuration, and consequently prehistoric winter campsites are most frequently found on large tributaries. Comparable large tributaries in other areas on the Plains should similarly fulfil these conditions. Small tributaries, because of limited surface water, would only infrequently provide the necessary requirements for winter occupation. Again, as previously noted, along any specific tributary, local factors may be present that could initiate microclimatic conditions that may or may not appreciably alter these frequencies. For example the presence of natural springs may enhance surface water availability,thus increasing site frequencies; while the presence of a cobblestone substratum would act against beaver occupation, thus decreasing site frequencies.

On the Canadian Plains,an important and pronounced example of ecological differences is demonstrated when comparing the mainstreams of the Qu'Appelle and Saskatchewan Valley Complex systems. The Qu'Appelle River is a former glacial spillway, explaining its distinct geological features: an underfed stream situated on an extremely broad flood plain. The Saskatchewan River is of preglacial origins (Kent 1968:5), thus formed by different geological processes. It mainly owes its distinctive features to the erosional activities of waters originating in the Rocky Mountains. As a consequence it is deeply incised with extremely narrow floodplains. However these contrasting geological features elicit a similar response in terms of human settlement patterns. Both features, the extremely broad and treeless floodplains of the Qu'Appelle River; and the general absence of floodplains of suitable extent on the Saskatchewan, limit the suitability of these waterways as wintering areas. In this case the contrasting ecological features did not contradict the human settlement patterns predicted in the model. But it must be pointed out that living systems are never exacting and are in continual flux; the intensities of the interrelationships flow and ebb. Therefore through time and space there will always be deviations and/or exceptions to the broad trends and/or patterns implied by any ecological model. At the same time ecological systems exhibit a remarkable resilience to major perturbations, so that basic linkages or patterns tend to persist, and thus are predictable. The ethnohistorical record also strongly implies that the aversion to beaver hunting has broader geographic applicability. The aversion to beaver hunting can be demonstrated among other aboriginal groups. The Hidatsa,village tribes on the Missouri, were reluctant to hunt beaver. Charles MacKenzie, a fur trader, observed,"Beaver were plentiful, but the Indians will not take the trouble of attending them" (in Masson 1889:331). Prior to contact, the Cheyenne were not beaver hunters (Grinnell 1972:104). Citing ethnographic references, Marriott (1974:5)notes the the Osages considered the beaver their ancestors and did not kill them. Murphy and Murphy (1960:5) note that the Shoshone were not fur trappers, and that the bulk of the furs was removed from their lands by free trappers. Among the Comanches the beaver ceremony was the most powerful of all curing ceremonies. During the performance of the ritual, beaver ponds and effigies were reconstructed (Wallace and Hoebel 1964:175-177). The evidence thus strongly suggests that the aversion to beaver hunting persists within a larger Plains framework; and it also continues to be expressed through the ideological beliefs of the associated peoples.

PLATES

Plate 1 Campbell II: northeast-facing slope; dam I in foreground.

Plate 2 Campbell II: waterway crossing the floodplain.

Plate 3 Campbell I: primary dam/pond unit V.

Plate 4 Campbell I: secondary dam/pond unit II.

Plate 5 Thompson III: primary dam/pond unit I with lodge.

Plate 6 Moose Jaw River: beaver dam in mid-summer.

Plate 7 Moose Jaw River: beaver dam in late fall.

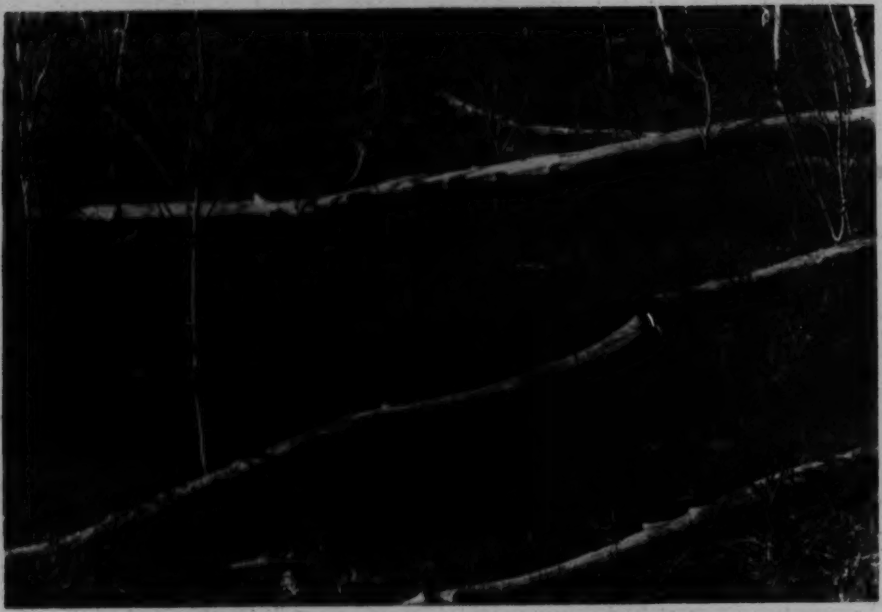


Plate 8 Cottonwood Creek: beaver -cut aspen.

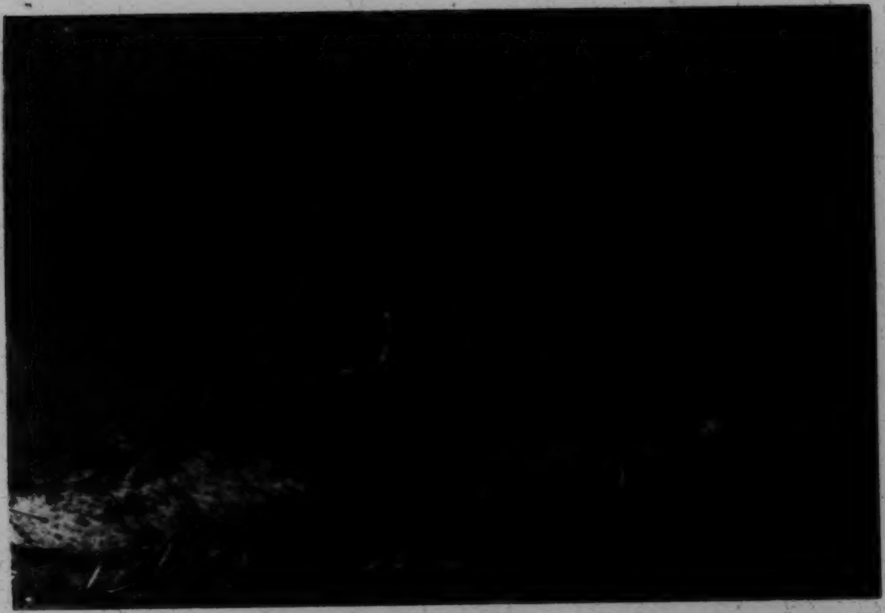


Plate 9 Cottonwood Creek: abandoned beaver lodge.

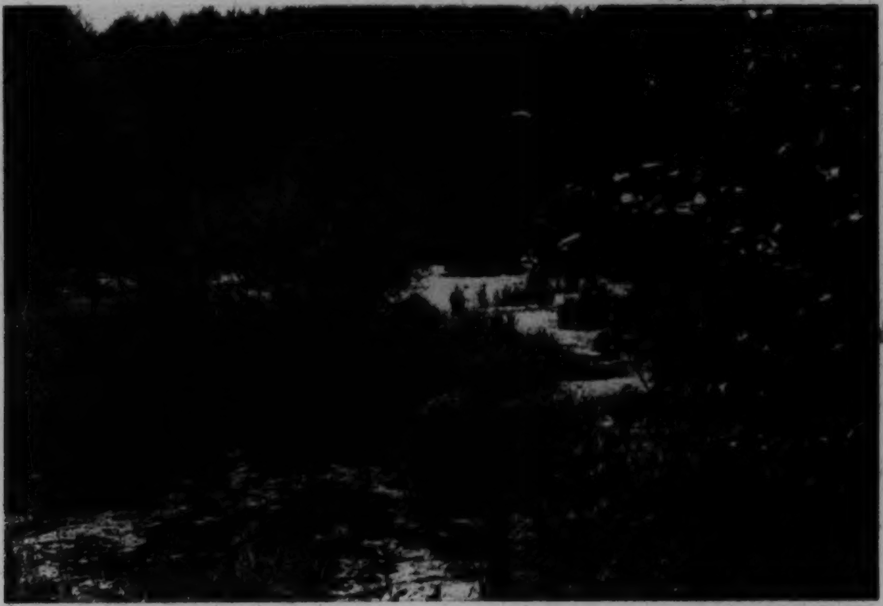


Plate 10 Elk Island National Park: site A

Plate 11 Elk Island National Park: site B

Plate 12 Elk Island National Park: block cutting of *Populus spp.* at site A.

Plate 13 Elk Island National Park: block cutting of ***Populus spp.*** at site B.

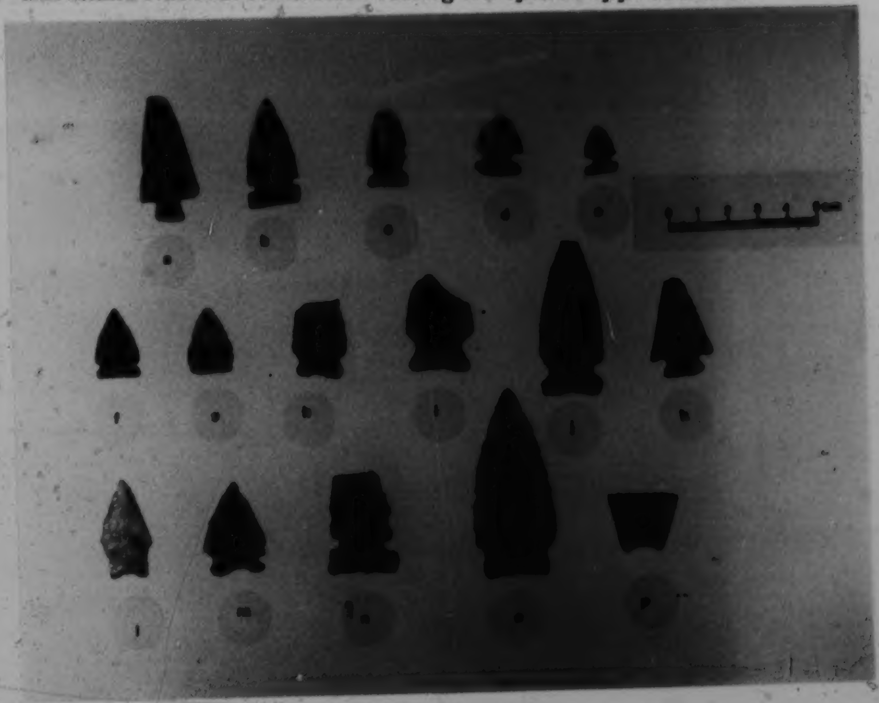


Plate 14 Pointed Bifaces: Historic a; Plains/Prairie Side-notched b, c, d, e; Avonlea f, g; Besant h, i, j; Pelican Lake k; Duncan/Hanna l; Oxbow, m; Bitterroot n; Lanceolate o,p

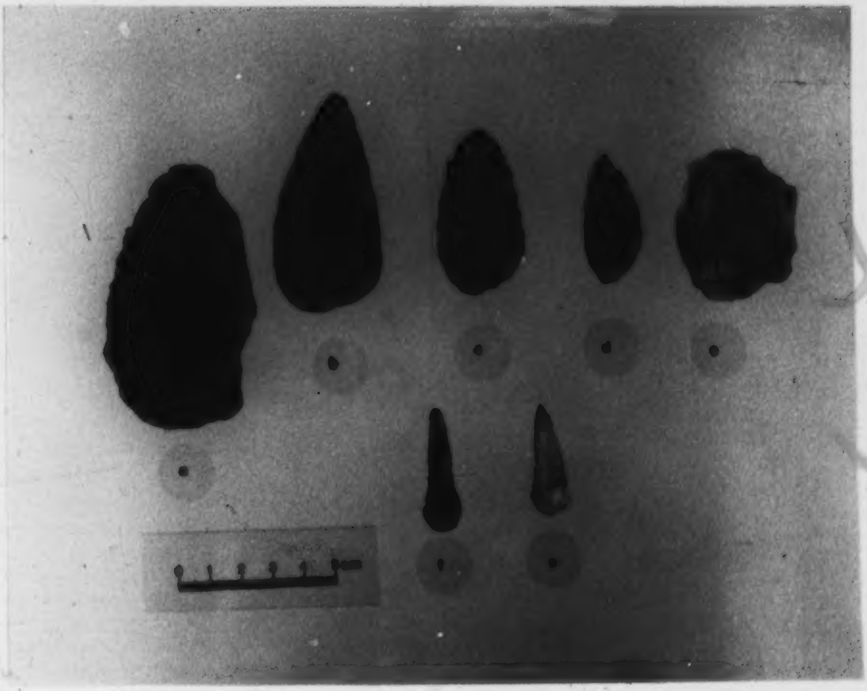


Plate 15 Lateral Bifaces: Large a, b,; Small, c, d; Preform e; Tubular Biface f, g.

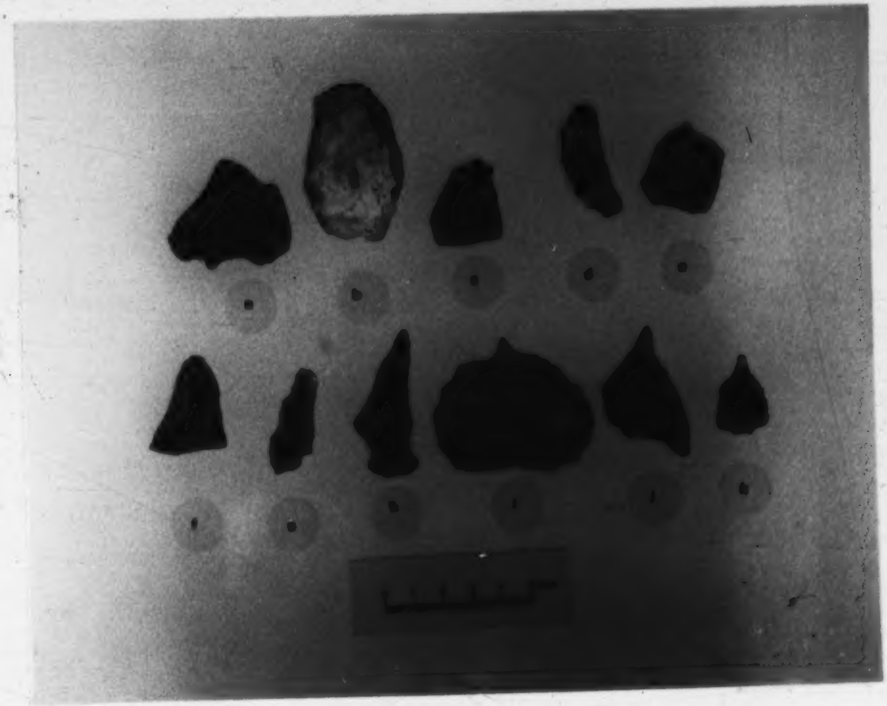


Plate 16 Lateral Unifaces: Pointed a; Small b-f; Tubular e-k.

Plate 17 Transverse Unifaces: Large a, b, c-j.

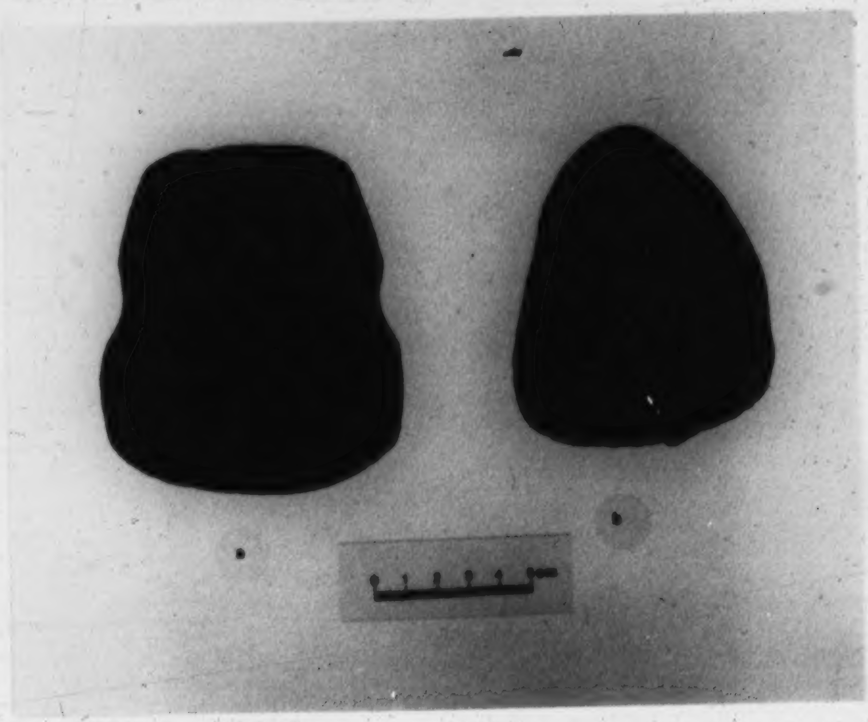


Plate 18 Grooved Maul; a; Pestle; b.

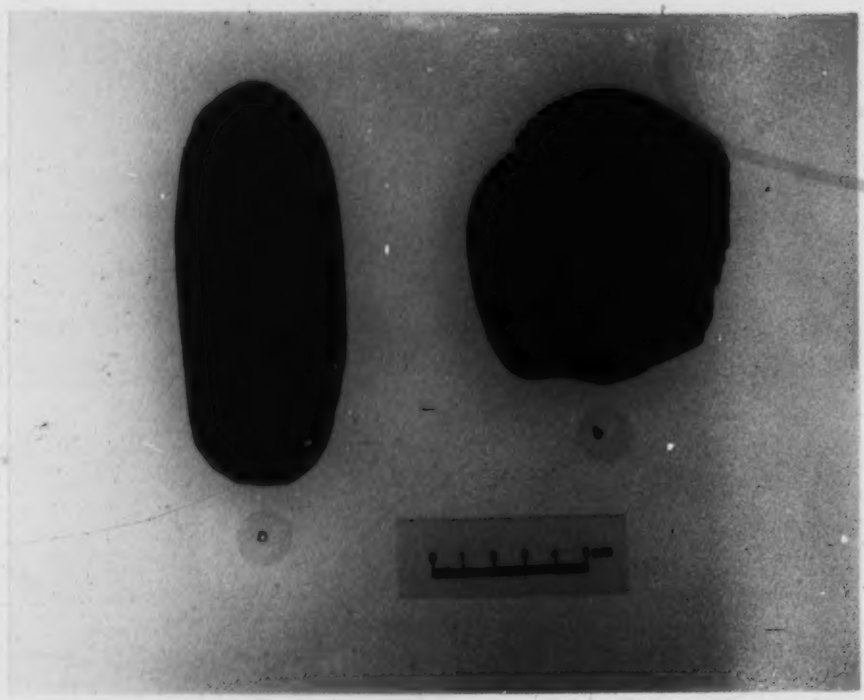


Plate 19 Hammerstone: a; End Core Tool; b.

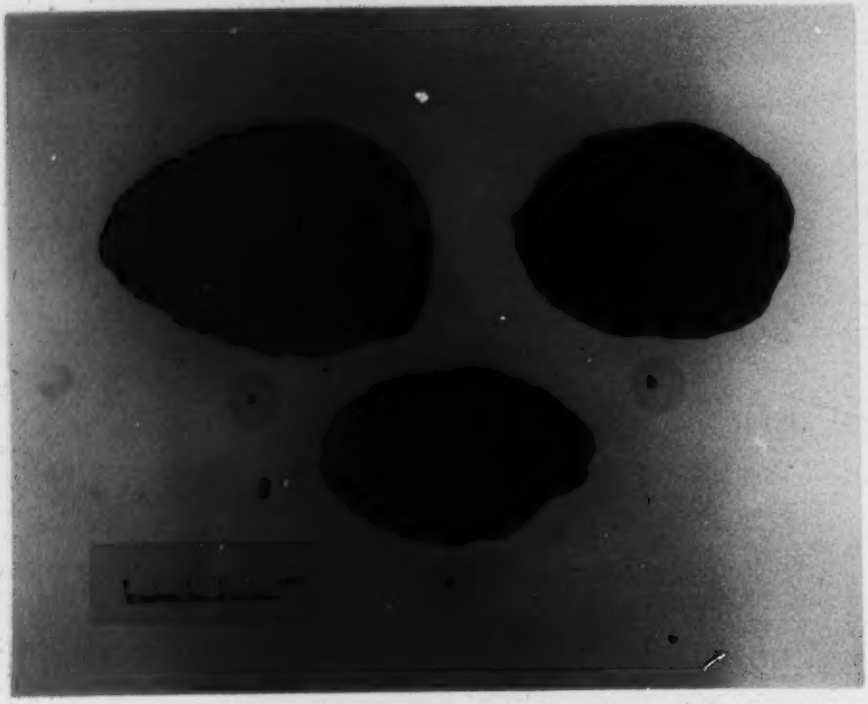


Plate 20 Surface Spall: a, b; Secondary Decortication Spall: c

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APPENDIX I

ECOLOGICAL SITE DESCRIPTIONS

COTTONWOOD CREEK

At the initiation of study (July 15, 1986) Campbell I, which extended for approximately 0.60 river kilometers, contained six dams, three lodges, and one burrow (Fig. 5). There were two primary dam/pond units (III and V).

As the creek crosses the valley floor from the Campbell I research area towards a northeast-facing slope, the Campbell II research area begins (Fig. 5). Campbell II, which extends for approximately 0.75 river kilometers, included 4 lodges, 1 burrow, and 4 dams (3 primary (II, III, IV) and 1 secondary).

Thompson III, which extends for approximately 0.41 river kilometers, consists of 3 primary dam/pond units and 8 lodges (Fig. 6). The large number of lodges, positioned at different levels along the creek edge, attests to the long-term occupancy of the area by beaver populations.

General Overview

Cottonwood Creek ranges from 2.2 km of stream/km^2 of land surface at the Thompson II research area, to 2.8 km/km^2 at its confluence with Wascana Creek, with an overall meander factor of 2.5 km/km^2. Cottonwood Creek also has a low gradient (0.121%), with valley width generally ranging from approximately 125 m to 250 m.

Pronounced climatic fluctuations, characteristic of the plains, are reflected in the yearly flows. During a thirteen year period (1974 to 1986), discharge (cubic meters per second) ranged from 0.000 cms in 1973 and 1981, to 1.70 cms in 1974, with a mean of 0.452 cms. During the year maximum discharge tended to occur in April, with a mean of 2.85 cms. The above discharge variability is also reflected in the number of days of surface water flow per annum, ranging from 0 in 1973 and 1981 to 178 days in 1974, with an average of 81.6 days. Initiation and termination of flow also shows some variability, beginning as early as February (1984 and 1986), and continuing as late as October (1974). However, flow most commonly begins in March or April; and generally has ceased by July (Water Survey of Canada; Station 05JF011; Cottonwood Creek near Lumsden). Correlation between discharge volume and days of flow was quite high (r^2=0.63). The above data indicate that in Cottonwood Creek stream flow is generally intermittent under all climatic conditions.

During the period under investigation (1986, 1987, and 1988), intensifying drought conditions strongly affected the volume of spring runoff, which progressively diminished, with a corresponding effect on duration of stream flow. The mean discharge in 1986 was 0.087 cms, with flow ending in early June (97 days); in 1987 it was 0.037 cms, with the flow ending in mid-April (33 days); in 1988 there was no flow (0.000 cms) (Water Survey of Canada 1987-88). The overall mean discharge flow during drought was 0.041 cm. Maximum discharge during spring runoff, with little or no flow for the rest of the year, establishes a general pattern in water level fluctuations; i.e., high levels in spring progressively dropping to low levels in fall.

The above generalities are deceptive, implying a degree of uniformity that rarely occurs. During any one year surface water resources are unevenly distributed along Cottonwood Creek, mainly because of two factors: marked microclimatic variability (a major attribute of the Valley Complex), combined with the effects of beaver, which through their dam/pond systems, create their own environments. Even at initiation of study, which also marked the beginning of the drought cycle (1986), many sections of the waterway became dry stream beds by fall; and most of the remaining water resources tended to be restricted to beaver-influenced areas, or artificial reservoirs.

The vegetation of Cottonwood Creek can be more easily generalized because, unlike beaver-influenced water resources, it is directly affected by local factors of a more constant, and therefore discernible nature, the most significant being aspect of slope and positioning of the creek on the valley floor. Tree/shrub species are not abundant in Cottonwood Creek valley; however, they do reach their highest densities on northern exposure slopes, particularly north - northeast-facing ones. Give the north - south orientation of Cottonwood Creek, most northeast-facing slopes are located on the west side of the creek, while north-west slopes tend to be located on the east side.

Although individual tree/shrub species showed considerable variability both in distribution and abundance, some broad patterns could be discerned. Aspen is absent from many areas; but when present is located most often on middle and lower portions of northern exposure slopes, and on flood plains proximal to the slope edge. Since it is rarely a riparian species, aspen is generally outside the beaver's forage range; but when accessible is readily utilized. Less frequently stands of ash occur, mostly on northeast-facing slopes, on the associated flood plains; and infrequently in proximity to the creek's edge. Elm is present but not abundant. In terms of distribution, maple is the most common tree species, being found in association with most northern exposure slopes, on the adjacent floodplains, and along the banks of the waterway when it approaches a northern exposure slope. Maple, however, never occurs in great numbers. The most abundant and ubiquitous shrub species in the Cottonwood Creek area is chokecherry. It is the major component of treed areas on northern exposure slopes, coulees, and on the associated floodplains; and it also can be found at the stream edge. Saskatoon and hawthorn are present in much lesser quantities, but are usually found within the beaver foraging range. Willow and dogwood are the most abundant riparian species. Rose is also a common riparian species; but it has a wider distribution, extending some distance out onto the adjacent floodplains. Herbaceous vegetation, i.e., grasslands, dominate the floodplains and southern exposure slopes.

Beaver Habitat

Along the tributary, beaver occupation, or evidence of it, is almost always present when a particular spatial configuration occurs; i.e., when the waterway is in proximity to a treed northern exposure slope; and water resources are of sufficient quantity that the beaver, through their dam/pond systems, can effectively maintain the pond depth and extent essential for dwellings and access to food caches. In terms of beaver habitat, there are some marked advantages to this clustering of attributes. When the waterway comes in proximity to northern exposure slopes, particularly northeast-facing ones, trees/shrub species may be continuous from the valley rim to the stream edge and to some extent beyond to the other side. The general literature indicates that the beaver has a narrow foraging range. Therefore, the above combination of attributes would greatly enhance resource availability, in terms of both food and construction materials; and conserve energy output.

Another important attribute is that suitable banks for beaver lodges and dams are also more likely to be found along the waterway when it approaches a slope edge. The slope, acting as an impediment, contributes markedly to increased erosional activities, the result being that the stream is more deeply incised in the vicinity of a slope wall. Higher banks (more suitable for lodges), and often a deeper waterway (greater volume of water), provide an initial combination of attributes that can be more easily manipulated or controlled by beaver activities.

Another factor enhancing beaver occupation is that treed slopes increase and, to a lesser degree, help maintain surface water resources. Spring runoff originating from snow melt provides most of the surface water resources. Treed slopes increase snow capture, thus increasing the initial amount of spring runoff. The shading effect of both trees and slope reduce the rate of water loss. Beaver ponds directly associated with treed slopes registered significantly higher rises in water levels during spring runoff. A habitat variation on the above is that when the stream cuts a slope edge incised by gullies and/or coulees, these physical features also concentrate snow, and in addition precipitation, so that the associated pond registers higher water levels during spring runoff, and drops in water levels during summer are retarded. It is specifically this latter habitat variation, exemplified by lodge 4 at Campbell II (Fig. 5) and lodge 1 at Thompson III (Fig. 6), that appears to provide the best conditions for survival, these being the only two colonies that were able to remain in the study areas during the drought cycle.

One variable that cannot be adjusted for and acts against any initial beaver occupation is a cobblestone substratum, a feature which occurs quite frequently, and in areas which otherwise would be suitable for beaver habitat.

Another common habitat configuration occurs when the waterway is more centrally located on the valley floor (Plate 2) During high water the surrounding floodplains are often inundated, markedly reducing erosional activities; and banks are rarely of sufficient height for use as dwellings. Also, when the waterway is more centrally located, riparian tree/shrub, (mostly shrub) species, may be absent; or if present, extend about 5 m (rarely 10 meters) from the stream edge. Therefore, being shallow and with little canopy, these sections of the waterway are highly susceptible to evaporation. Even during normal climatic conditions these areas contain water only during the early part of the vegetative season, and thus are unsuitable for beaver occupation.

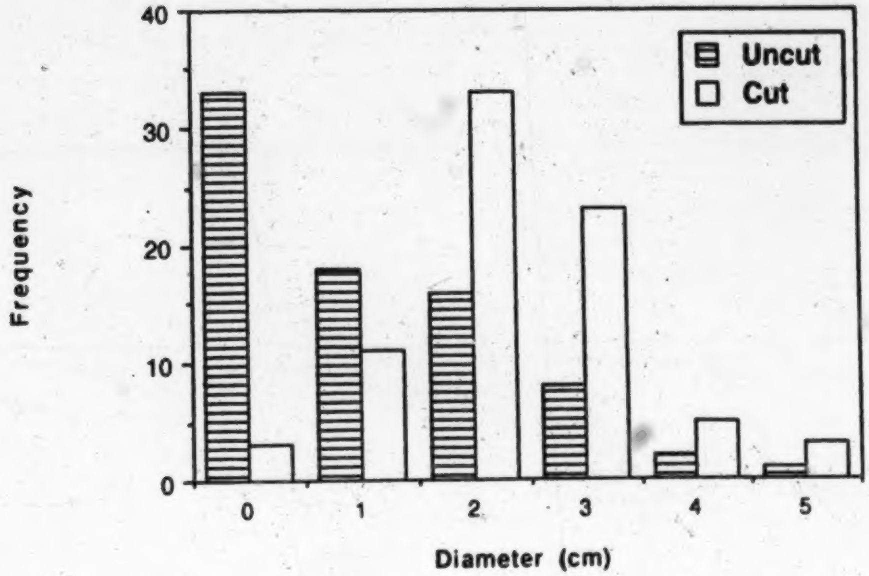
The above two habitat types generally lie at opposite ends of the broad spectrum of habitat variability found in the Valley Complex system. Not only a wide range of factors, but a large number of factor recombinations create this variability. If the effect of beaver activities is added, the variability further increases. Not only does each beaver-occupied area have its own unique combination of physical and/or vegetation attributes, but surface water resources are not equally available or as easily maintained. These conditions elicit a range of differential responses from the resident beaver populations.

Beaver foraging strategies exhibited some patterns of use. The abundance and accessibility of chokecherry is reflected in these strategies. Chokecherry is the major source of materials used in the construction of dams and lodges, and also is found in food caches. At Campbell I beaver selected for larger diameter (2-4 cm) chokecherry trunks (Fig. 16); and chokecherry was the main component in their dams and lodges (Fig. 17). This preference for larger diameter size forms is ecologically advantageous. The species is more resistant to beaver cutting, as the removal of larger diameter size specimens accelerates growth in the smaller sizes. This use pattern was also observed with dogwood and shrub-size willow. Aspen is generally outside of the beaver's foraging range, but is readily utilized when accessible.

A distinct foraging pattern was also discerned for maple. First, the main trunks (ranging from 17 to 34.8 cm in diameter) were not removed from the sites when felled by beaver. Also beaver use of maple was minimal. Only small areas of bark were eaten from the lower portions of the trunks, and branches were infrequently removed for construction purposes. The primary impetus for felling these trees appears to be a strong preference for open canopy. As a result, regardless of diameter size, those in close proximity to stream edge, and particularly those in proximity to lodges, are felled first. This overriding preference for open canopy explains the high wastage or non-use of many felled trees. This phenomenon is most strongly prevalent during initial occupancy of an area. In subsequent years use of maple is minimal and generally seasonal. In spring bark is often stripped from the lower portions of large trees, frequently without felling them.

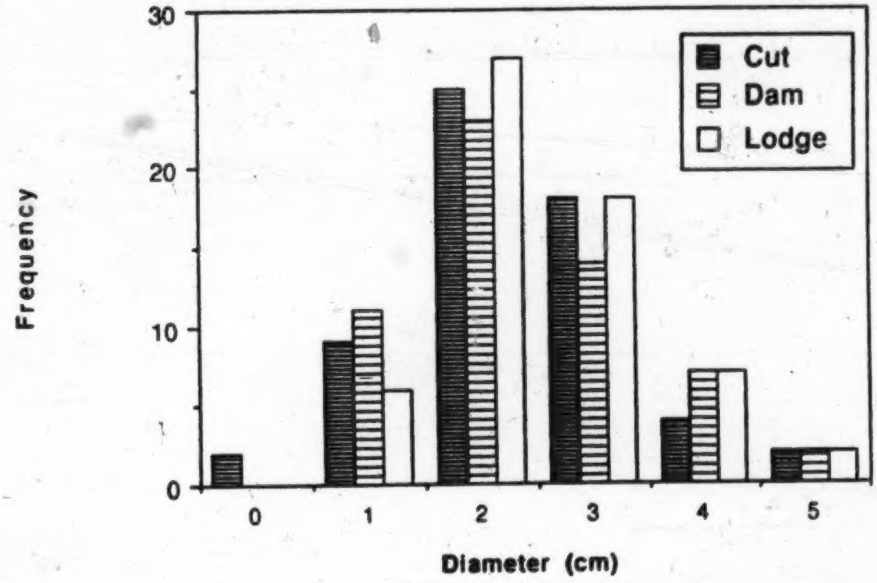
The extent of use of herbaceous materials (grasses/sedges) was indeterminant, as beaver and cattle both competed for the same resource. However, in late fall the use of woody materials increased substantially, not only in terms of food cache construction, but immediate use. The curing of grassland species may be a contributing factor to the above increased usage.

The vegetation associated with the waterway also exhibited marked microclimatic variability: at Campbell I tree species were restricted to maple; at Campbell II maple and,



DF=5; Chi-Square=84.682; P=<0.00.

Figure 16 Beaver Selection of Chokecherry by Diameter Size.



Dam: DF=5; Chi-square=10.243; P=0.07
Lodge: DF=5; Chi-square=5.41; P=0.37

Figure 17 Beaver Selection of Lodge and Dam Materials as Compared to Cut Chokecherry Populations

in smaller numbers, ash and elm were found; at Thompson III tree species were not observed.

Tree/shrub species selected for winter food varied in abundance and species type. Dogwood was found in all the food caches, and was often the most abundant. At one colony, willow was almost exclusively the most important food source. Other species found in food caches were chokecherry, saskatoon berry, and to a lesser extent rose. At two sites it was also found that although willow resources were almost completely depleted in the immediate vicinity of the lodge, beaver chose to utilize alternate sources, usually dogwood, rather than forage greater distances (still within the suggested beaver foraging range) for willow. Tree species were rarely found in the food caches.

The Effect of Beaver on the Environment

The objective of this section is to determine the nature and extent of beaver conservation of water resources, which will be examined from the following two perspectives: the effectiveness of beaver dam/pond systems in maintaining water resources, and the determination of the structural mechanisms operative in beaver water control.

A major problem in the analysis was to distinguish the effects of climatic variables from those attributed to beaver behaviour. There was, therefore, a heavy reliance on climatological data such as precipitation rates, discharge flow, and temperature. These were continually cross-referenced with the data provided from measurements of water depths and water level fluctations. However, there are many variables affecting the above dynamics which are beyond the scope of this study. It is therefore hoped that the available information will provide an accurate, if not precise, assessment of the effects and extent of beaver activities on surface water availability in the Cottonwood Creek Valley.

The analysis focused mainly on the beaver dam/pond system in the Campbell I research area, where water depth measurements were carried out for a three year period, encompassing the drought cycle of 1986-1988 (Tables 1-3). Water measurements were also carried out at Campbell II and Thompson III in 1988 (Tables 4 and 5).

In regards to beaver control and maintenance of surface resources, some general features were discerned. There are two kinds of beaver dam/pond units: primary and secondary. Primary units are built when a beaver colony first occupies an area, and contain the lodge (resident colony). Since spring runoff is almost the entire source of surface water resources, beaver activities are directed at its capture and maintenance. Primary dams are thus built to contain the waterway completely. It appears, however, that this initial damming process rarely provides the depth essential for overwintering; i.e., sufficient depth for access from lodge to food caches. Dams are thus built not only from bank sediments, but in a primary unit, from bottom sediments as the beaver deepen the pond to the necessary depth, which Todd (1978:18) estimates at 0.9 to 1.5 m. Therefore a simultaneous deepening and broadening of the beaver pond occurs.

To test further the assumption that beaver deepen primary ponds, the stream width/water depth measurements from Campbell I and II were combined for a total of 1.35 river km to give a larger sample of lodges for statistical analysis. Water depths were significantly greater in proximity to lodges (Fig. 18). Similarily, at the Thompson III site the water depth mean (80.213) at the lodges was significantly greater than the mean depth (53.282) of the overall waterway [DF=7; t=2.532; Prob.=0.02].

The statistical analyses also indicate a strong, although variable, correlation between stream width and water depth at the three research areas. The correlation was particularly strong at Campbell I; (r^2=.89). Measurements were taken at the height of the drought, when the remaining water resources at this site were mostly confined to primary beaver dam/pond units. The strong correlation reflects the simultaneous deepening and widening of primary beaver ponds. The weaker correlations at Campbell II (r^2=.65), and

TABLE 1: WATER LEVEL FLUCTUATIONS: CAMPBELL I: 1986

		Measurements (cm): water loss or gain (+)					
		Pond I	Pond II	Pond III	Pond IV	Pond V	Pond VI
D	July 15	0	0	0	0	0	-
A	24	25	14	5	10	2	0
T							
E	August 1	27	5	5	2	3	1
	17	23	26	15	18	17	14
O	24	5	14	5	5	8	-
F	31	-	8	20	7	7	-
R	TOTAL LOSS(cm)	80	67	50	42	37	15
E							
A							
D							
I							
N							
G							
S							

TABLE 2: WATER LEVEL FLUCTUATIONS: CAMPBELL I; 1987

		Measurements (cm): water loss or gain (+)						
		Pond I	Pond II	Pond III	Pond IV	Pond V	Pond VI	Pond VII
D	June 5	0	0	0	0	0	0	0
A	19	23	19	9	10	8	7	15
T								
E	July 3	19	16	10	10	12	5	8
	5	9	11	2	6	2	3	0
O	1	+5	+4	1	+3	0	+2	0
F								
	August 2	+3	4	1	5	7	2	+4
R	15	17	24	11	10	5	14	9
E	27	5	1	+2	3	6	10	3
A	30	+2	+4	6	1	0	0	1
D								
I								
N	TOTAL LOSS	63	67	38	42	40	39	32
G								
S								

TABLE 3: WATER LEVEL FLUCTUATIONS: CAMPBELL I: 1988/89

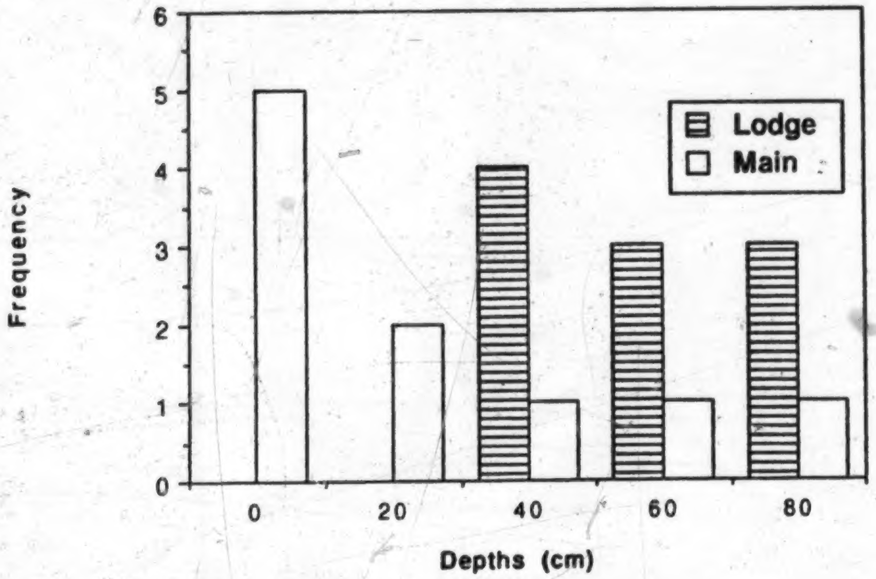
		Measurements (cm): water loss or gain (+)									
	POND	1	2A	2B	3	4	4A	5A	5B	6	7
	INITIAL DEPTH	22	13	62	98		67	133	137	106	113
DATE OF READINGS	May 29/88	0	0	0	0		0	0	0	0	
	June 5	12	13	10	5		5	5	5	6	
	15			19	5		5	5	5	5	
	30			10	9		12	16	12	12	
	July 17			18	8		11	10	13	12	0
	28			2	5		14	10	11	14	10
	August 16			9	6		8	10	8	7	11
	September 1				6		7	7	9	10	10
	October 1				3			11	12	16	13
	30				3			9	9	17	11
	TOTAL LOSS	22	13	62	50		67	83	84	99	55
	DEPTH	0	0	0	48	0	0	50	53	7	58
	April 23/89	+77	+71	+97	+93	+59	+77	+47	+45	+69	+52
	DEPTH	77	71	97	141	59	77	97	98	76	110

TABLE 4: WATER LEVEL FLUCTUATIONS: CAMPBELL II: 1988/89

			Measurements (cm): water loss or gain (+)				
			Pond I	Pond II	Pond III	Pond IV	Pond V
		INITIAL DEPTH	60	99	109	120	136
DATE OF READINGS	June	5/88	0	0	0	0	0
		15	4	10	18	3	2
		30	14	10	17	20	11
	July	1	14	8	3	0	5
		28	17	13	10	10	7
	Aug.	19	10	9	5	4	7
	Sept		-	7	5	4	3
	Oct	1	-	14	7	5	3
		30	-	10	0	2	2
		TOTAL LOSS	59	81	55	48	40
		DEPTH	-	18	54	72	96
	Apr.	/89	+109	+52	+29	+35	+69
		DEPTH	109	70	83	107	165

TABLE 5: WATER LEVEL FLUCTUATIONS: THOMPSON III: 1988/89

			Measurements (cm): water loss or gain (+)		
			Pond I	Pond II	Pond III
	INITIAL DEPTH (cm)		158	115	100
D	July	13	0	0	0
A	July	8	5	3	4
T	July	28	9	6	9
E					
	Aug	20	11	6	9
O	Aug	26	1	4	3
F	Aug	31	2	2	7
R	Oct	30	8	5	7
E					
A					
D	TOTAL LOSS		36	30	34
I					
N	DEPTH		122	85	66
G					
S	Apr/89		153		144(+)
	DEPTH		275		210



DF=4; Chi^2=24; P=<0.00

Figure 18 Campbell I/II: Water Depth Comparisons Between Lodges and Overall Waterway.

at Thompson III (r^2=.59) reflect more favorable water resources, that is, more continuous, so that measurements are not reflecting only beaver dam/pond units.

The structural nature of dams greatly facilitates surface water conservation. All dams are triangular in cross-section; therefore the deeper the pond, the larger the dam and the broader its base. As water levels drop the width of the associated dam surface increases, porosity decreases, and outward flow from the pond decreases. In primary dam/pond units, which are the deepest, this process continues to the point where the dam becomes impermeable, and total containment of water resources occurs; often the case during drought (Plate 3). This process, plus the fact that deep ponds are more resistant to evaporation, greatly contributes to water retention in the primary dam/pond unit (Tables 1-5).

Secondary dam/pond units have several features which distinguish them from the primary ones. First, they are generally shallow; that is, they are not centrally deepened. The dams appear to be primarily constructed from bank sediments, so that ponds tend to have their deepest points along the bank wall. Because the ponds are not deep, these associated dam surface is still permeable at its broadest point (Plate 4). Water continues to percolate through dams until ponds become dry. In other words, although more susceptible to evaporation, the structural properties of a shallow dam/pond unit allow most of its surface water to percolate downstream. As previously noted, as water levels drop, water resources in deeper dam/pond unit eventually become locked into a self-contained unit. This development brings us to the major function of secondary dam/pond units. If upstream from a primary dam/unit, they serve to regulate and prolong flow of water resources into primary units, thus replenishing them during the vegetative season. If downstream from a primary dam/pond unit, they back up water resources against the primary dams, reducing downstream outflow.

All dams have the downstream side reinforced with tree/shrub trunks and branches, while the upstream side is mainly mud (Plate 3). Large rocks, as well as sections of lumber, telephone poles, etc. are often incorporated into the primary dams. Secondary dams as compared to primary dams also have structural differences which contribute to their functional nature. First, they are not as compact; and appear to contain greater amounts of wooden materials, suggesting greater porosity. Most primary dams in the study area are compact and solid, and in composition mostly earth. These attributes may to some extent also reflect greater maturity; i.e., the effects of beaver maintenance. Nevertheless, primary dams are highly resistant to climatic or other perturbations such as trampling by cattle; and continue to function as water containment units long after beaver abandonment.

In support of the above interpretations, it was found that primary dam/pond systems, especially those containing active lodges, were the most stable, experiencing the least fluctuations in surface water resources (Tables 1-5). Secondary dam/pond units experienced not only the most rapid but generally also the greatest water loss, often becoming dry by the end of the vegetative season.

There are several climatic factors influencing the availability of surface water resources. The most significant is spring runoff, the result mainly of snowmelt. The amount of surface water captured by a beaver dam/pond system in spring is the most important factor determining whether an area can be maintained. This factor is facilitated by several other physical features. As previously noted, if a primary dam/pond is associated with a treed slope, or a slope with breaks such as coulees or gullies which increase snow capture, spring runoff will be substantially higher. The shading effect of tree/shrubs and the slopes themselves would also reduce evaporation, in turn increasing the amount of spring runoff. During the vegetative season beaver dam/pond systems operate to maintain these surface water resources. More specifically, the structural features of both primary and secondary dam/pond units function to maintain sufficient water resources in the primary unit containing the lodge.

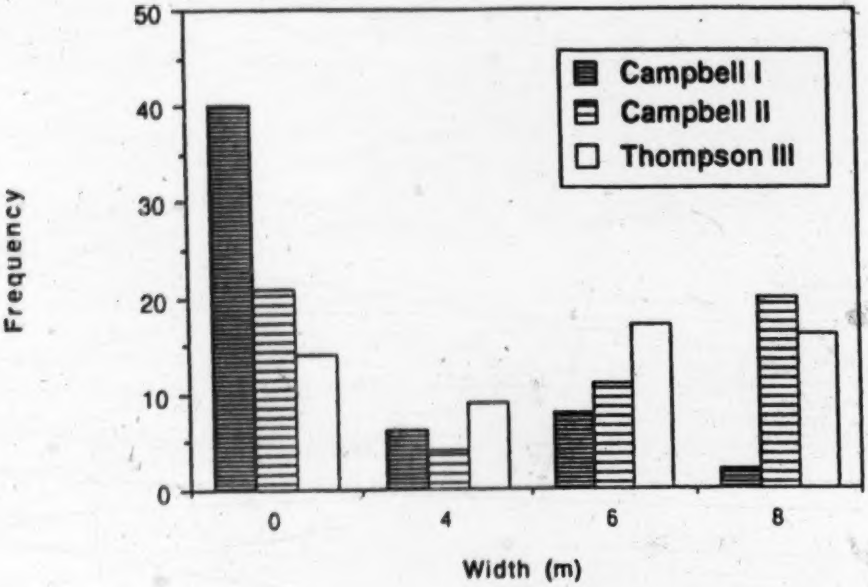
Evaporation is the most important factor causing water loss in the beaver ponds. Temperatures determine the rate of evaporation. Precipitation can retard the effects of evaporation; that is, slow the rate of water loss; but is generally ineffective when temperatures are abnormally high. During the height of the drought of 1988, the previous winter was dry; thus there was no spring runoff. Also abnormally high temperatures, resulting in high evaporation rates, plus abnormally low summer precipitation brought about the disintegration of many beaver dam/pond systems.

Spatial distribution changes during initial occupation of an area, stemming from the beaver's preference for open canopy, resulted in most large trees, generally maple, being removed from the vicinity of the lodge; and to some extent both downstream and upstream along the stream edge. The removal of trees stimulated a succession to more herbaceous species, and shrubby species such as chokecherry and saskatoon berry. There is also some evidence that when water resources were more favorable, some of the larger (tree-like) willows fringing the stream in low-lying areas may have been killed by beaver-induced flooding, as they do not appear to have been heavily utilized. At no time during the study was there evidence of any serious depletion of tree/shrub species by beaver use. There is no doubt that tree species are not abundant in the Cottonwood Creek valley; however, they did not play a pivotal role in beaver habit requirements, reflecting the flexibility and/or opportunistic nature of beaver behaviour.

In addition the three research areas (Campbell I and II; Thompson III) exhibited structural variations, and marked differences in the abundance of surface water. Water depth and stream width measurements were carried out at all three research areas. Between Campbell I and Campbell II there was a significant difference in the frequency distribution of water widths (Fig. 19); and a significant difference in the frequency distribution of stream depths (Fig. 20). In other words, the amount of surface water in the Campbell II beaver dam/pond system was significantly greater. In turn, the water depth frequency distribution pattern of Thompson III was significantly different from Campbell II (Fig. 20); and also the stream width distribution pattern was significantly different (Fig. 19). Thompson III exhibited the most favourable surface water conditions in the research areas. The differences in the amount of water were reflected in the structural nature of the beaver dam/pond systems. At the Campbell I area beaver were forced to construct an elaborate system to main a sufficient supply of water. From 1986 to 1988, the number of dams ranged from 6 to 8, with two dams being primary (associated with lodges), while the remaining ones were secondary. At Campbell II there were three primary dams and one secondary. At the Thompson site all three dams were associated with lodges. Beaver worked much harder at Campbell I to maintain a viable dam/pond system.

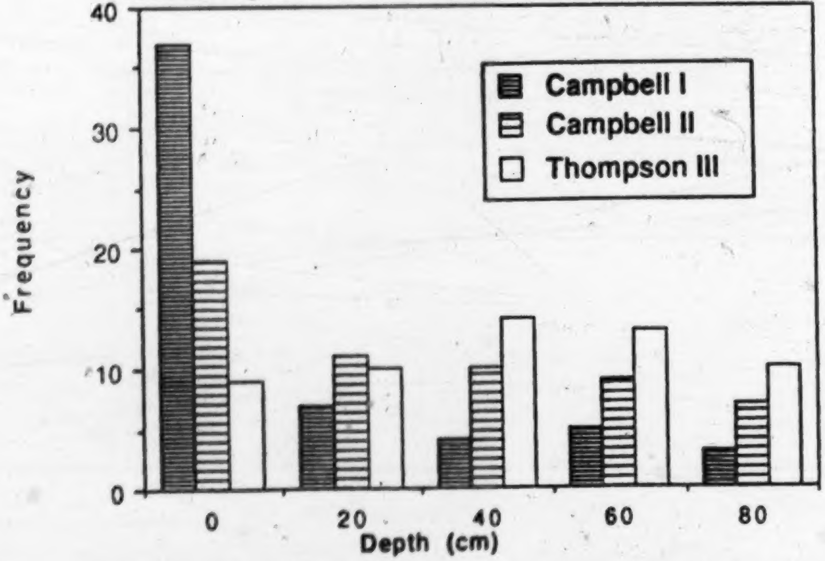
The Effect of Drought on Beaver Movements

Campbell I, having been monitored during the entire drought cycle, provided the model for many of the observations. It also afforded the opportunity for a temporal perspective on the effects of drought on a beaver dam/pond system, and how the resident beaver populations coped. It was observed that the initial factor in lodge abandonment was fluctuations in water levels. More specifically, a marked drop exposed lodge entrances, necessitating movements, generally localized, to lower levels (Plate 9). One of the effects of drought was that as surface water resources became depleted, the beaver dam/pond system began to disintegrate into a series of smaller ponds; from 6 to 11 at the Campbell I site. The final localized beaver movement was to one of these smaller ponds. It was suggested that abandonment of this pond was due to lack of space to accommodate both lodge and food cache, as water depths were adequate. A similar situation arose at another area on Cottonwood Creek, where the resident beaver colony was able to open up a channel to an adjacent pond in which the food cache was constructed. Returning to discussion of Campbell I, it was assumed that the beaver colony then established residence at Campbell II. It was forced to abandon the tributary midway through the 1988 season, due to lack of sufficient water depth. One of the colonies at Thompson III site, likewise, was forced to



Campbell I and II: Df=3: Chi^2=172.817; P=<0.00
Campbell II and ThompsonIII: DF=3; Chi^2=12.656; P=0.005

Figure 19 Cottonwood Creek: Comparison of Stream Widths at Different Beaver Dam/Pond Systems.



Campbell I and II: DF=4; Chi^2=28.576; P=<0.00
Campbell II and ThompsonIII: DF4; Chi^2=10.018; P=.04

Figure 20 Cottonwood Creek: Comparison of Water Depths at Different Beaver Dam/Pond Systems.

abandon the area because of insufficient water depth. Therefore insufficient water resources, more specifically, insufficient depth is the major factor initiating major and more permanent movements from the tributary.

The differences in surface water availability at the three research sites were reflected in the response of beaver colonies to drought conditions. Because its water resources were more limited, by 1988 at Campbell I the interconnectedness of the beaver dam/pond system had ceased. The beaver ponds had become discrete isolated units, with some ponds separating into a series of smaller ponds, from an original of 6 to 11 ponds. Beaver populations had abandoned the area by the fall of 1987. The more favorable water resources at Campbell II were demonstrated in several ways. The overall depletion in the individual ponds (Table 4) was not as great as at Campbell I. At the initiation of study surface waters were continual throughout the study area, and two active beaver colonies were present; one colony was possibly an emigrant from Campbell I. Although some ponds (3 and 4) did separate into smaller discrete units by the end of October, the overall response to drought was not as severe as at Campbell I. The beaver dam/pond system at Thompson III exhibited the most stable conditions, and generally retained its interconnectedness. Surface water supplies were even more favorable than at Campbell II, and overall fluctuations in water levels were reduced.

By the end of the season (October 30) at both the Campbell II and Thompson III sites one of the resident colonies was forced to migrate because of inadequate water resources. The remaining colony at each site was able to remain and overwinter in the area. Water depths at the active ponds were as follows: Thompson III - 122 cm at Lodge 1 (Fig. 6); Campbell II - 96 cm at Lodge 4, (Fig. 5) (Tables 4 and 5). The Campbell reading was very close to the minimum considered as adequate for overwintering.

It must be strongly stressed that the research areas chosen for analysis greatly exaggerated the availability of surface water resources in Cottonwood Creek during drought. Many beaver-occupied areas became dry stream beds. The overall reality by the end of the drought cycle was a tributary that was mostly a dry stream bed dotted infrequently by small isolated pools of water, the majority being abandoned beaver ponds. More specifically, by October 1988, only six active beaver lodges were observed along Cottonwood Creek from the confluence with Wascana Creek to Dewdney Avenue. One lodge was associated with an artifically deepened part of the waterway, and therefore will be omitted from the tally, leaving five active lodges or 0.13 lodges/river km. The number of active lodges previous to this time is indeterminate. The extensive mobility of the individual colonies influenced by drought conditions made calculations of this nature problematic. For example, the resident beaver colony in the Campbell I research area possibly occupied two different lodges during the period from 1986-87 and then abandoned the area, presumably taking up residence in the Campbell II area, in the fall of 1987, which it then permanently abandoned by the early fall of 1988. However, during the period under investigation there were at least thirteen areas that exhibited evidence of beaver occupation, which were abandoned by the fall of 1988.

MOOSE JAW RIVER (Fig. 7)

General Overview

The Moose Jaw River meanders from approximately 1.8 km./km^2 of land surface at its confluence with the Qu'Appelle River, to 2.6 km/km^2 at the site area. The Moose Jaw River also has a low gradient (0.016%); and a valley width ranging from approximately 500 m to 600 m, approaching the confluence with the Qu'Appelle River. From 1914 to 1986 (data available for 55 years), annual discharge flow ranged from 0.000 cms in 1981 to 13.5 cms in 1974, with a mean of 2.64 cms (Water Survey of Canada 1987-88; Station No. 05JE001; Moose Jaw River above Thunder Creek). During the year maximum discharge occurred in April, with a mean of 120 cms. The number of days of surface flow/annum was markedly variable, ranging from 0 in 1981 to 312 days in 1922, with a mean of 190.8

days. Discharge flow most commonly began in March and ended in October; but has been recorded as early as January, and continuing as late as December. In other words, stream flow is continuous during the vegetative season. The above data base also suggests a pattern of maximum discharge in spring, with gradually reduced flow during the rest of the year, often continuing well into October.

During the period under investigation (1986-88), intensifying drought conditions caused a progressive reduction in discharge volume. In 1986 discharge volume was 1.40 cms (123 days of flow); in 1987 it was 0.099 cms (125 days flow); and in 1988 it was 0.001 cms (46 days flow), with a mean of 0.500 cms, which was markedly below the overall mean of 2.64 cms.

The study area is not overly representative of the physical attributes generally associated with a large tributary. The primary consideration was to locate a site with the least disturbed surface water, an objective which entailed selecting an area some distance upstream. As a result, the distinction between slope and floodplain often is not well-defined. In some areas the river is so deeply incised that the banks of the floodplain take on the semblance of a slope wall, both in depth and in being extensively treed (Plate 7).

Tree/shrub species are the predominant vegetation forms in the study area. Poplars fringe the slope edges, but are generally outside the beavers' foraging range. Ash is the most abundant tree species; and is particularly plentiful on northern exposure slopes, from the stream edge to the upland prairies. It is also a riparian species extending continuously along the deeply incised stream banks. Although not as abundant, maple has the same distribution patterns. Rose, willow, and dogwood are all riparian species; but their distribution is discontinuous. Chokecherry is the most common and ubiquitous shrub. Quantitative analyses were not carried out on any of the plant species.

Beaver Habitat and the Effects of Drought

There is a clustering of beaver lodges where the waterway approaches a northern exposure slope, but this distinction is not pronounced. As previously noted, the banks of the deeply incised waterway provide suitable, almost continuous, habitats for tree/shrub species. Being densely covered by these species, the banks are also highly stable. These conditions reflect the more ubiquitous distribution of beaver populations. The clustering of lodges that does occur on northern exposure slopes is related to the fact that these slopes are entirely treed, and food resources are more abundant. Most of the floodplain is under cultivation, so that herbaceous material is generally in short supply.

Examinations of food caches found that ash was the most abundant winter food, followed by maple and chokecherry. Small quantities of willow were also observed.

At the initiation of study (at the height of the drought) the research area, which encompasses 4.1 river km of stream (Fig. 7), contained 16 lodges (No.5 was a burrow). Five of the lodges (2,10,12,13, and 16) were active. Old food caches were found in association with lodges 3, 5(burrow), and 16. Recognizable dams totalled eight, while possible dams and/or fans totalled six.

Lodge 1 was abandoned at the initiation of the study. It was already deteriorating, and entrances were exposed. Its water depth was 85 cm, suggesting that exposure of entrances, rather than insufficient depth, was the impetus for abandonment. Lodge 2 was active, but was abandoned shortly after; insufficient depth (63 cm) appeared to be the reason for abandonment. Lodge 3, as well as the burrow (5), both had food caches which were relatively undisturbed. These colonies may have been hunted out during the previous winter. Lodge 3 had sufficient depth (95 cm), and no exposed entrances, lending credence to the above interpretation. Lodges 4 (depth 55 cm), 6 (depth 47 cm), 7 (depth 82 cm), and 8 (depth 76 cm) are associated with a highly disturbed area; clear-cutting of trees to the bank edge by the farmer destroyed food resources, and contributed extensive wood debris to the waterway. These lodges are also highly deteriorated, suggesting abandonment may have been more than a year before observation. Factors other then insufficient depths may have played a role in abandonment, such as the destruction of food resources. Lodge 9 had exposed entrances, which is assumed to be the reason for abandonment. Lodge 10 was active during the whole season. At this lodge by October 30 water levels had dropped to 94 cm, which was still sufficient depth for the resident colony to overwinter successfully. Lodge 11 was abandoned at initiation of study; water depths were adequate (90 cm), and lodge entrances were not exposed, so that the reason for abandonment is not known.

No water measurements were available for the rest of the lodges. Lodge 12 was active, but abandoned towards the end of the season. Entrances were exposed, suggesting a drop in water levels as the main factor in abandonment. Lodge 13 and 16 were active during the entire season, and food caches were built in late September. Lodge 16 was interesting in that an old food cache was still present in front of lodge; however, a new food cache was added on. Lodge 14 was situated quite high on the bank, suggesting use during times of much higher water levels. Lodge 15 was unoccupied when study was initiated, and was partly deteriorated.

In late fall (Sept/Oct) new colonies were established at A and B (Fig. 7), which were burrows with food caches.

Surface water analyses were complicated by the presence of a spring in the study area, which influenced the abundance of surface water. In turn, the spring may have affected the distribution pattern of beaver populations in the research area. In the fall, along 5.8 river km, which includes the research area, there were seven active lodges of which four were concentrated in the area (1.3 river km) that was influenced by the spring. Overall lodge density was 1.2 lodges/river km.

In summary, the initial factor affecting beaver movements was exposure of lodge entrances, followed by insufficient water depth. Beaver movements were localized, where surface water was more abundant. During late fall movements, beaver do not build lodges.

The Effect of Beaver on the Environment

Although only one research area was established on the Moose Jaw River, and analyses were carried out for only a short period (mid-August to October 30), some clues did emerge as to the availability of surface water resources on a large tributary during drought. It was found that the extent and distribution of water resources was variable, with a general pattern of long stretches of continuous water, separated by smaller sections of dry stream beds containing occasional pools of water. More specifically, the research area encompassed 4.1 stream kilometers of continuous water. Immediately downstream was a section of dry stream bed of approximately 0.7 stream kilometers in extent, from which another stretch of continuous water (approximately 1 stream km) occurred.

To provide a more precise perspective on the availability of water resources, water depth and stream width measurements were taken along 1.54 stream km of the waterway within the research area (Lodge 11 to Lodge A) (Fig. 7). The presence of a spring in the study area complicated the ecological analyses. The spring flow was of sufficient quantity to affect water depths in the vicinity, and its influence appeared to extend as far as the roadway. The roadway and a beaver dam significantly reduced the downstream movement of water. The statistical tests indicate that the mean depth (89.182) of the waterway influenced by the spring (from lodge 11 to roadway) (Fig. 7) was significantly greater then the mean (59.843) of the rest of the measured waterway from roadway to Lodge A. [DF=21; T=6.301; Prob=<.00].

The dam/pond systems were generally open; that is, there was often a channel present at one end of dam allowing for free movement of water and beaver populations (Plate 6). Beginning sometime in late September, closure of these dams became complete (Plate 7); and the dams began to function as containment units, thus regulating stream flow.

The swifter flowing water in the river resulted in greater erosional, therefore, also depositional activities. When dams began to emerge after spring runoff, they are generally flat and fan-like in outline. Strong stream flow had eroded the top of the dam and deposited sediments along the closed end. Because of the erosional and depositional activities, the structural aspects of the original dam were often obscured. Since the low water levels also exposed other areas that were fan-like in outline, it was sometimes difficult to discern which ones were the dams.

A Chi-square test of significance was carried out to determine if the distribution of water depths measurements at the lodges were significantly different than those in the overall waterway. It was found that they were not [DF=4; Chi^2 = 5.333; Prob =.25]. There were several factors acting against statistical confirmation of beaver activities significantly deepening the waterway in proximity to the lodges. Because a large tributary is subjected to greater erosional activities, deepened areas around abandoned lodges are quickly filled up by siltation. Also, the site itself was highly disturbed; abandoned lodges such as 4, 5, 6, which had low depth readings, were associated with areas having high accumulations of wood debris that accelerated the siltation process.

THE QU'APPELLE RIVER

The more general aspects of the Qu'Appelle River Valley are discussed in chapter II. More specifically, the Qu'Appelle river is 364.8 miles (587.0 km) long, with a meander factor of 1.8 to 2.6 (mean 2.2) miles mile of valley length. The channel gradient ranges from 0.5 to 1.5 ft/mi, with a mean of 1.0 feet/mi. During 1987 mean discharge at Lumsden was 4.32 cms. In 1988, at the height of drought, it only dropped to 4.13 cms, reflecting the artificial control of water resources. Although water levels are artificially maintained, the following data give a broad perspective of the nature of surface water resources. Maximum discharge still occurs during spring runoff. In 1987 discharge flow peaked in May at 19.0 cms; while in 1988 there were two peaks, one in April (spring flow) registering 7.35 cms, and a later peak of 9.0 cms in July (Water Survey of Canada; Station No. 05JF001; Qu'Appelle River near Lumsden).

A major distinguishing feature of the Qu'Appelle River valley is its broad floodplain, which varies from one to two miles in width. As a result most treed areas, which commonly fringe slopes or cover northern exposure slopes, are inaccessible to the beaver populations. Sherratt and Hatch (1977:14) noted that the low percentage of aspenfound in food caches was due to the species' inaccessibility.

The following information on beaver populations in the Qu'Appelle Valley is derived from a publication by Sherratt and Hatch (1977), which is based on a beaver survey carried out along the main waterway. During the years 1975 to 1976, 525.1 km of stream were surveyed from Nicolle Flats to Lumsden, then east to the Manitoba-Saskatchewan border (Fig. 2). During this time 321 active lodges were recorded. Using an average of five beaver per colony (from Denny 1952), they calculated a minimum of 1,605 beaver along the surveyed area. The overall density of beaver colonies was 0.61 lodges/river km. Beaver densities for specific areas were highly variable, ranging from 0.47 lodges/river km to 0.84 colonies/river km. Marked seasonal variations were also recorded. In an area east of Craven (Fig. 2) a resurvey on October 22 (1975) found 10 more active lodges, increasing the 15 lodges found on October 16 to 25, an increase of 66% (1977:11). In 1976, on 30 river km of the Qu'Appelle river, in the Neudorf area, 31 active colonies were observed on October 12-13; while on November 10, 46 active colonies were recorded, an increase of 48%. It was also distinguished that these colonies were not observed in the area previously. Three colony sites that were inactive in October became active in November, while three active sites in October became inactive in November. Therefore localized movements would only account for three colonies (1977:12). Sherratt and Hatch (1977:11) concluded that the significantly higher later count is due to late cache construction by many beaver. Only four beaver colonies were observed on the Qu'Appelle Lakes. Factors such as wave action and ice breakups were cited as making the lakes unfavorable for beaver occupation (1977:12).

Willow is the major food source, being found in 95% of the food caches, which numbered 189. The remaining tree/shrub species made only a minor contribution to the winter food supply. Maple was found in 11% of the food caches, followed by ash (15%), dogwood (6%), and chokecherry (4%). Saskatoon, aspen, rose, and other were found in less than 4% of the food caches (Sherratt and Hatch 1977:12). The food cache composition reflects the fact that Qu'Appelle River tends to be more centrally located on the valley floor, only infrequently cutting the edge of a slope. As a result riparian species are the major source of food.

According to Sherratt and Hatch (1977:14), beaver are found solely in bank dens. Lodges are not built because of swift stream flow, and because of the lack of building materials such as large aspen trees. The latter reason is unlikely, as during this study beaver were observed to utilize shrublike species such as chokecherry for construction needs.

As previously noted, Sherratt and Hatch attributed the marked increase in active colonies between mid-October and mid-November to late food cache construction; however, a short duration drought occurred in 1976 (Lang and Jones 1988:2). It is therefore inferred that the above marked increase in beaver populations is due to movements of beaver populations from less favorable habitats (on smaller tributaries) to the main waterway. The causal factor is insufficient surface water, a condition that intensifies during drought. This phenomenon also was observed in 1975 when there was no drought, suggesting that beaver population movement from smaller to larger tributaries may be to some extent a seasonal event, with a return to the former habitats in spring, when surface water resources are more favorable.

APPENDIX II

ARCHAEOLOGICAL SITE DESCRIPTIONS

The following archaeological site descriptions are ordered first by tributary, then by site type. Each individual site is then discussed in terms of location, site character, and cultural materials. Descriptions of artifact categories can be found in Appendix III.

COTTONWOOD CREEK SITES (Fig. 13)

A. INFERRED TEMPORARY CAMPSITES: (i) Frequent Use

1) Confluence site (EdNf-21)

Location: The site is centrally located on the floodplain with Cottonwood Creek on its west boundary, and Wascana Creek on the east. A dry stream bed of Wascana Creek is also present in the site area. The field is under cultivation.

Site Character: The artifact concentrations, bone, and to a lesser extent FCR (Fire Cracked Rock), tend to be found along the stream edge of both tributaries. The largest concentration of materials including tools were found along the outer edge of the dry stream bed. The open nature of the site suggested use during temperate conditions.

Cultural Materials: FCR; Bone; 7 Flakes and shatter (5 chert, 2 silicified peat); one Small, Thin, Transverse Uniface of chert; one Surface Spall Tool of quartzite; one Complex Core of chert. The Chipped Stone Tool category is represented by one type (Table 10).

2) Young I (EdNf-26)

Location: The site includes the area closest to the municipal road. The prehistoric component lies on the first terrace, along the west side of the tributary, which is in close proximity to a northwest-facing slope. The historic component (an old homestead) is more centrally located on the floodplain. The area was originally cultivated, but is now a pasture. Vegetation reaches its greatest density on the east side of the stream. At initiation of study, beaver had abandoned the area.

Site Character: Prehistoric artifact densities are greatest in the site area closest to the stream edge. Within the site area artifacts tend to be found in small clusterings, generally including bone, FCR, and percussion flakes. The historic component is primarily two cobblestone basements. Historic and prehistoric artifacts in the area are intermixed.

Cultural Materials: PREHISTORIC: Bone; FCR; 8 Flakes and Flake fragments (1 quartzite, 5 chert, 1 silicified peat, 1 quartz); one Shatter of quartzite; two Notched Pointed Bifaces of chert; one Small, Thin, Lateral Uniface of KRF (Knife River Flint); one Complex Cobble Core of quartzite; one Secondary Decortication Spall fragment of quartzite. The Chipped Stone Tool category is represented by two types (Table 10).

HISTORIC - Nails-4; Glass-9 fragments; China-4 fragments; one Bullet Shell; one Binder Chain.

3) Young II (EdNf-27)

Location: The site is located south of EdNf-26, and is mainly centered around a dry stream bed. A small tributary (dry) enters the creek from the east. The area is now used as pasture, but at one time was cultivated. At initiation of the survey (1986), beaver had abandoned the site area; however, evidence of their occupation (dam/ponds) was still evident. A beaver colony temporary reoccupied a pond adjacent to the site in the spring of 1987, but abandoned it in the fall when water resources became inadequate.

Site Character: Although artifact materials were found on both sides of the dry stream bed, the highest concentrations were on a low-lying area on the east side. Small clusterings or concentrations of Bone, FCR, and Flakes/Shatter are found distributed across the site, which is mostly not sheltered.

Cultural Materials: 18 Flakes and fragments (2 quartzite, 15 chert, 1 quartz); six Shatter (2 quartzite, 3 chert, 1 quartz); one Exhausted Core of quartz; one Small Thick Lateral Uniface of KRF; one Cobble End Core fragment of quartzite; three Cobble Secondary decortication flakes of Quartzite; one Cobble Surface Spall tool of quartzite; one Cobble Hammerstone of quartzite. In the General Debitage category chert is the preferred raw material, making up 72% of the sample, followed by quartzite with 16%. The Chipped Stone Tool category is represented by one type.

4) Volke I (EdNf-19)

Location: The site is found on a floodplain along the west side of Cottonwood Creek at its confluence with a small tributary. The site is generally under cultivation, but in 1986 was in fallow. On the east side of the creek is an abandoned homestead. The northeast-facing slopes are particularly well treed; and have a high frequency of aspen, which is being heavily utilized by beaver. A beaver dam is located in the immediate site area. A lodge is built into the west bank of the creek a short distance south from the dam. The beaver colony was able to maintain residence during the duration of the recent drought.

Site Character: Small clusterings of bone, FCR, and lithic debitage are found throughout the site; however, the highest densities are along the northeast-facing slope and creek edge. The site is reasonably well-sheltered.

Cultural Materials: Artifacts were mostly left in situ; and consisted of Flakes, Shatter, Cores, and Core fragments. Collected materials include three Flakes (2 chert, 1 quartzite); one Cobble Secondary Decortication Flake of quartzite; one core fragment of Petrified wood.

A INFERRED TEMPORARY CAMPSITE: (ii) Infrequent Use

1) Lax I

Location: The site area is located on the floodplain and first terrace, along the east side of Cottonwood Creek. The area was previously plowed, but has been reseeded to grass. I could not discern any evidence of beaver in the area. The adjacent stream bed is dry.

Site Character: The artifact materials, which appear to be a single clustering, are located near the stream edge. The area is quite open.

Cultural Materials: Left in situ: FCR, Bone, Flakes, and Shatter. The artifact density was scant. Site use at best was minimal; possibly a single event situation.

2) Lax II (EdnF-24)

Location: The site is located on the floodplain and first terrace, along the west side of Cottonwood Creek. The site was previously plowed, but has been reseeded to grass. The creek in the site area is completely dry, and continues as such for a short distance beyond two badly eroded beaver dams. The creek then becomes a marsh; and to the north, gradually becomes a deep pond containing an active bank lodge.

Site Character: Lithic artifacts are scattered rather evenly across the site area. Although no FCR and only one bone fragment were observed on the surface, these materials were collected from a testhole. Since the area is quite rocky it is possible that some quarrying of lithic materials may have occurred during camping. The site area is not sheltered, suggesting use during temperate conditions.

Cultural Materials: One Complex core of chert; 12 Flakes and fragments (2 quartzite, 8 chert, 2 silicified peat); 16 Shatter (5 quartz; 1 silicified peat, 10 chert); four Cobble Spall fragments of quartzite; one Cobble Surface Spall Tool of quartzite; one Cobble Secondary Decortication Spall tool of basalt. In the General Debitage category chert has the highest raw material frequency with 66.6%, followed by quartz at 18.5%.

3) Lax III (EdNf-25)

The site is located on the east side of Cottonwood Creek in a pronounced west bend, just before its confluence with a tributary. It is also associated with a treed north-facing slope. The site has not been disturbed; natural prairie is still found throughout the area.

Site Character: Artifact materials were scattered across the floodplain and first terrace. Bone was not found; and artifact clustering, if present, could not be discerned because most of the site was buried. Nevertheless, the nature of the observed material points to short-term occupancy.

Cultural Materials: Left in situ - Core fragments; FCR (sparse); and Flakes. Collected - one Shatter of quartzite; three Flakes (1 quartzite, 2 chert); one Cobble Surface spall of quartzite.

4) Volke II (EdNf-20)

Location: The site is located primarily on the floodplain along the west side of Cottonwood Creek; however, artifact materials in small frequencies are also found along the east side of the creek in association with a northwest-facing slope. The site consists of small sections of natural grasslands intersected by fallow areas. The creek bed is dry in the site area. Although the beaver have abandoned the area, there is evidence of their occupation in the presence of cut maples and poplars, which are abundant in the area.

Site Character: The site area is quite open on the west side, with artifact materials concentrated along the stream edge. Artifact densities are very low; and spacing between clusters is extensive, suggesting only infrequent use. An eroding stream bank along the creek indicates two occupation levels.

Cultural Materials: All materials were left in situ; and consisted of Bone, FCR, Shatter, and Core fragments and Flakes.

5) Old Well (EdNf-28)

Location: The site is located on a floodplain and first terrace on the west side of Cottonwood Creek. Except for numerous cowpaths leading to the creek edge, the site was essentially undisturbed natural prairie. An old abandoned well is located on the edge of the first terrace. In the site area are two beaver dams and a lodge constructed in the east creek bank. By 1988, the stream bed was dry; and beaver had abandoned the area.

Site Character: Artifact densities appear low; however, the site is mostly an undisturbed area, so that most materials would not be exposed. The cultural materials observed give no reason to suggest any degree of permanent occupation. The site is situated in an open area, suggesting that shelter was not a great concern.

Cultural Materials: Artifacts left in situ include Shatter, Flakes, Core fragments, Bone, and FCR. Collected artifacts include five Flakes (1 quartzite, 3 chert, 1 silicified wood); one Cobble Secondary Decortication spall of quartzite.

6) Thompson I (EdNf-31)

Location: The site is located on the east side of Cottonwood Creek, on the first terrace; and extends to its confluence with a tributary entering from the east. The area is mostly cultivated except for a small southern portion near the tributary, which is natural prairie. A dry stream bed is directly to the west of the site.

Site Character: Artifact clusterings occur in an open area along the western edge of the site. Along the southern edge, which partly runs along a treed northwest-facing slope, is another clustering of artifacts which also is in close proximity to the dry stream bed.

Cultural Materials: Artifacts left in situ include Bone, FCR, Flakes and Shatter.

B. INFERRED WINTER CAMPSITES

1) Thompson II (EdNf-32)

Location: The main site is located on the west side of the creek on the floodplain, but mainly on the first terrace along a northeast and east-facing slope. The floodplain area is under cultivation (a wheat field), while the first terrace has been reseeded to grass. Along the northeast-facing slope is a garden plot. A beaver lodge and a broken beaver dam are located in the site area where the creek cuts the edge of the northeast-facing slope . This was one of the areas that retained surface water resources during the recent drought cycle. The other part of the site is situated on the floodplain, and is separated from the main area by the contemporary Cottonwood Creek. A dry stream bed suggests that in earlier times it was part of the main site. This area is heavily treed, and disturbed by massive earth displacements which which occurred in the construction of a dyke.

Site Character: Cultural materials are clustered along the east-facing slope along a roadway. A gridded surface collection (2 m^2 plots for a total of 35) was carried out in the area; however, more specific artifact clustering could not be discerned. Overall artifact densities appear greater than those observed in the temporary site category. Artifact materials were also found along the north-east facing slope in a low-lying garden area, but they were not as numerous.

Cultural Materials (Table 6): The site yielded 28.76 kilos of FCR. Bone fragments totalled 136, of which most were highly fragmented. The few identifiable were bison (Dale Walde, personal communication). In the General Debitage category (a sample of 145) Flakes and Fragments represent 64.1%, Shatter represents 24%, and Cores 6.9%. Pressure flakes have only a small representation, but they are difficult to discern. Chert is the most common lithic raw material, representing 39.3% of the sample, followed by silicified peat at 27.6% , then quartzite with 16.5%. In this sample KRF has only a 2% representation.

Eight tool types were recognized in the Chipped Stone tool category. The tool assemblage, however, is too small for any significant frequency patterns to emerge. Besant points have the highest representation; 50% or two specimens. There is one Avonlea and one Plains/Prairie point. Other tools include a biface fragment, several fragmented Thin Unifaces, and three Transverse Unifaces (end scrapers). The incisor is more indicative of activities that would suggest a more prolonged occupation; i.e., skinwork or incising. Spall tools continue to be an integral part of the assemblage.

In the area separated from the main site by the contemporary Cottonwood Creek, there are heavy concentrations of bone material (identifiable fragments are bison). No other artifacts, with the exception of a small frequency of FCR, were found in the whole site area.

2) Campbell site (EdNf-29)

Location: The site is located on both the west and east sides of Cottonwood Creek. The site also has a historic component, an abandoned homestead. The area was previously plowed; but has been allowed to revert back to grass, and is now used as a pasture. The site area on the east side of the stream is associated with a heavily treed northeast-facing slope. The floodplain and lower slopes are still in natural prairie. Several dry stream beds are also found on the floodplain.

The site area has active beaver colonies, and was chosen as one of the test areas for measuring the effects of beaver activities on the environment.

Site Character and Cultural Materials: On the west side cultural materials tend to concentrate towards the stream edge. It is generally an open area except for the portion adjacent to the heavily treed northern exposure slope. Grasses and other vegetation generally obscured the archaeological picture.

Cultural materials left in situ include Flakes, Cores, Shatter, Bone, and FCR. Historic items include ceramics, nails, and glass. Artifacts collected include a Pointed Biface fragment of chert; three Flakes (2 silicified peat, 1 chert); one Shatter of chert; one Pressure flake of chert, one Small Thin Transverse Uniface of KRF. Only two Chipped Stone Tool types were recovered.

Artifact densities appear substantially greater on the east side of the stream. Although the area is undisturbed, thus mostly buried, rodent activity was extensive, exposing large quantities of Bone, FCR, Flakes, Shatter, and Cores. Artifact densities appear greatest along the dry stream beds. A Quartzite Pestle was recovered from one of the rodent holes (Plate 19, b).

TABLE 6: LITHIC ARTIFACT CLASSIFICATION: Thompson II (EdNf-32)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				7			7								
Flakes and Fragment				93	14	32	32	9	1	2				1	
Shatter Flakes & Blocks				35	8	7	12	5						2	
Cores And Fragments				10	2	1	6	1						3	
TOTAL				145	24	40	57	15	1	2			1		145
TOOLS															
SERIES	CLASS	SUBCLASS	[4]Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	1		1									
			Avonlea	1		1									
			Besant	2			2								
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform	—											
		FRAG		—											
	TOTAL			4		2	2								
	LATERAL	LARGE	Thick												
			Thin	—											
		SMALL	Thick	—											
			Thin	—											
		FRAG		1			1								
	TOTAL			1			1								
	TUBULAR			—											
TOTAL				5		2	3								5
UNIFACIAL POINTED															
	LATERAL	LARGE		—											
		SMALL	Thick	1			1								
			Thin	—											
		FRAG		5		1	3		1						
	TOTAL			6		1	4		1						
	TUBULAR	INCISER		1					1						
	TOTAL														
	TRANSVERSE	LARGE													
		SMALL	Thick	2			1		1						
			Thin	1		1									
		FRAG		—											
	TOTAL			3		1	1		1						
TOTAL				10		2	5		3						10
TOTAL															15

COBBLE STONE INDUSTRY		[5]DEBITS	TOOLS		DEBITS	TOOLS
SERIES	CLASS					
SPALL	SURFACE	1	1	1		
	END	2		2		
	SECONDARY DEC[6]	1		1		
TOTAL		4	1	4	4	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3 Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

A large spring campsite (EdNf-2,5) is found on the adjacent uplands, on the west side of the waterway.

C) INFERRED SPRING CAMPSITE

1) EdNf-2

Location: This is a large upland site which shares the area with site EdNf-5. Part of the area is slightly elevated so that a good view is available of not only the tributary but the surrounding prairie. The area was once cultivated, but has been converted to pasture. It appears to have approximately the same dimensions as EdNf-3, extending also about 0.8 kilometers from the valley edge. The combined sites extend along the valley rim, generally encompassing the area associated with the Campbell site (EdNf-29) on the floodplain. Again, this part of the valley bottom is one of the few beaver dam/pond systems that retained water during the recent drought cycle as well as an active lodge.

Site Character: Because the site has become pasture, most of the surficial archaeological evidence is obscured by vegetation. Clusterings of FCR were discerned across the site.

Cultural Materials (Table 7):

Out of a sample of 100, flakes make up 77% of the General Debitage, while Pressure/Retouch Flakes represent 8%. No cores were recovered. Chert is again the most common raw material, representing 46% of the assemblage, followed by KRF and then silicified peat.

Of the recognizable projectile point types (15), the Plains/Prairie (20%) and Besant (20%) types represent the highest frequencies. On this site diagnostic point types go as far back as the Early Plains Indian Period (Dyck 1983). The unnotched form is represented by two specimens (13%). Most tools that would be classified as winter campsite furniture, i.e., mauls, hammerstones, anvils, and pestles, are not present. No pottery sherds were recovered from this site. The Chipped Stone Tool category is represented by eighteen types (Table 10).

2) EdNf-5

Cultural Materials (Table 8): The site falls within the same area designated as EdNf-2, but is in closer proximity to the waterway. Artifacts are primarily from a private amateur collection, which perhaps explains why worked tools predominate in the assemblage. Nevertheless, many patterns observed in the previous samples are present. In spite of the low representation in the overall General Debitage category, a large number of chert cores were recovered. This factor is reflected in the fact that chert is again the most common raw material, making up 70.5% of the sample, followed by silicified peat at 13.6%.

The site collection is also significant in that it implies a broad time span in terms of occupation. Diagnostic projectile points suggest that occupation extended from the Historic period (represented by two metal points) back to an Early Plains Period Phase represented by an Agate Basin point base.

Within the sample of recognizable (75) projectile point types, including the unnotched form, the Plains/Prairie points and Besant points again have the highest representation at 18.66% and 29.3% respectively; followed by Pelican Lake points at 10.6%. The unnotched form makes up 14.6% of the sample.

Another important aspect is that the whole range of artifact tool types in the Chipped Stone industry is represented. There are tool categories such as the Transverse Unifaces (end scrapers), which have a large number of incomplete or broken specimens exhibiting extensive resharpening which could represent the discarding of the exhausted tool component of a winter tool kit. There were categories such as the Large Biface exhibiting both complete and incomplete specimens which mostly displayed no wear patterns; these could represent abandonment to lighten a tool kit prior to major movements. Perhaps more diagnostic is the absence of site furniture such as would be associated with a winter

TABLE 7: LITHIC ARTIFACT CLASSIFICATION: EdNf-2

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY

GENERAL DEBITAGE

	FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
Pressure/Retouch	8			2		6						
Flakes and Fragment	77	2	13	34	2	18	3	1	1	3		
Shatter Flakes & Blocks	15		2	10		3						
Cores and Fragments												
TOTAL	100	2	15	46	3	27	3	1	1	3		100

TOOLS

SERIES	CLASS	SUBCLASS	Type	FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	3			3								
			Avonlea												
			Besant	3		1	1		1						
			Pelican Lake	2		1			1						
			McK/Dun/Han[4]	2			2								
			Mummy Cave	1			1								
		LANCEOLATE		2			2								
		UNNOTCHED	Preform	2			1		1						
		FRAG		3			3								
	TOTAL			18		2	13		3						
	LATERAL	LARGE	Thick	1		1									
			Thin												
		SMALL	Thick	2			2								
			Thin	4		2	1			1					
			Preform	—											
		FRAG		2			1		1						
	TOTAL			9		3	4		1	1					
TOTAL				27		5	17		4	1					27
UNIFACIAL	POINTED			1					1						
	LATERAL	LARGE		1			1								
		SMALL	Thick	4			2						1	1	
			Thin	6			2		4						
		FRAG		14			5	1	8						
	TOTAL			25			10	1	12				1	1	
	TUBULAR	INCISER		4			2		2						
	TRANSVERSE	LARGE		4			4								
		SMALL	Thick	5			4				1				
			Thin	9			7		2						
	TOTAL			18			15		2		1				
TOTAL				48			27	1	17		1		1	1	48
TOTAL															75

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	DEBITS[5]	TOOLS		DEBITS	TOOLS
SPALL	SURFACE		1	1	2	—	
	SECONDARY DEC[6]		1		1	—	
TOTAL			2	1	3	2	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 8: LITHIC ARTIFACT CLASSIFICATION: EgNf-5

CHIPPED STONE INDUSTRY				FREQUENCY	LITHIC TYPE DISTRIBUTION QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Flakes and Fragment				112	7	13	77	6	4		1	1	3		
Shatter Flakes & Blocks				18		6	12								
Cores And Fragments				9			9								
TOTAL				139	7	19	98	6	4		1	1	3		139
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Historic	2										2	
			Plains/Prairie	14			13		1						
			Avonlea	2		1	1								
			Besant	22		3	14		2	1	2				
			Pelican Lake	8			4		3				1		
			McK/Dun/Han[4]	6			4				1		1		
			Oxbow	3			3								
			Mummy Cave	2					2						
		LANCEOLATE		5			4		1						
		UNNOTCHED	Preform	11			8		2				1		
		FRAG		44			36		8						
	TOTAL			119		4	87		19	1	3		3	2	
	LATERAL	LARGE	Thick	5	1	1	2							1	
			Thin	2			1				1				
		SMALL	Thick	8		3	4		1						
			Thin	4			4								
			Preform	7	1		6								
		FRAG		46		7	33		6						
	TOTAL			72	2	11	50		7		1			1	
	TUBULAR			1											
TOTAL				192											192
UNIFACIAL POINTED				6			3		1		2				
	LATERAL	LARGE		12			12								
		SMALL	Thick	8			7		1						
			Thin	29		2	15		7		3	2			
		SPOKESHAVE		5			5								
		FRAG		7			3		4						
	TOTAL			61		2	42		12		3	2			
	TUBULAR	PERFORATOR		6			4						2		
		INCISER		12		1	7		4						
	TOTAL			18		1	11		4				2		
	TRANSVERSE	LARGE		7		1	5		1						
		SMALL	Thick	36			25		6		1		4		
			Thin	45		2	23		18	1			1		
		FRAG													
	TOTAL			88		3	53		25	1	1		5		
TOTAL				173											173
TOTAL															365

COBBLE STONE INDUSTRY		DEBIT[5]	TOOLS		DEBIT TOOLS
SERIES	CLASS				
SPALL	SURFACE	1	1	2	—
	END SECONDARY DEC[6] FRAGMENTS	1		1	—
TOTAL		2	1	3	2 1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3 Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

campsite; e.g., Mauls, Pestles, and Anvils. A few pottery sherds (54 specimens) were recovered, suggesting a nearby winter campsite (perhaps Campbell EdNf-29). Large core tools associated with primary butchering also are absent; but again, may not have been collected.

In the bifacial series, chert is the most common raw material (63%), followed by silicified peat (18.5%) and KRF (14.8%). In the Unifacial series, chert is again the most common raw material (56%) followed by KRF (35%). The Chipped Stone Tool category is represented by twenty-six types (Table 10).

3) EdNf-3

Location: This is an immense site located on the prairie uplands on the west side of Cottonwood Creek. It extends west from the valley approximately 0.8 km, but reaches its highest artifact densities within the first 300 meters from the valley rim. It also appears to extend for about the same length along the valley edge. The site provides an excellent view of the valley and the tributary located on the east side of the valley. The site is also associated with a wooded northeast-facing slope. This area features the most stable beaver-dam/pond system on the tributary, which maintained surface water resources throughout the recent drought cycle.

Site Character: Because the soil was very sandy, the site was highly susceptible to erosional activities. Blowouts often occurred, resulting in pronounced vertical concentration of artifact materials. Bone materials, although not abundant, are present. FCR is generally ubiquitous across the site; however, some concentrations do occur.

Artifact Assemblage (Table 9): Flakes represent 86.9% of the Debitage category. There is some evidence of pressure flakes (7.7%) which reflect maintenance processes. For the overall Debitage category, chert has the highest representation with 42.2%, followed by KRF with 27.6%, then silicified peat with 12.6%. The Plain/Prairie (36%) and Besant (33%) are the most common point types. The unnotched form is represented by five specimens (14%). The presence of the McKean/Duncan/Hanna point type suggests site occupancy as early as 4700-3050 B.P. (Dyck 1983). Artifacts such as large bifaces and core tools, which would figure prominently in primary butchering processes, are generally absent or of limited representation. Many tools such as perforators are highly battered and broken, suggesting they are discard materials. Likewise, the Transverse Unifaces appear to be mostly exhausted tools. In both the Bifacial and Unifacial Tool categories, chert is the most frequently used raw material, followed by KRF, and then silicified peat. Sixty-one pottery sherds were also recovered from the site, suggesting carryover from a nearby wintering area. The Chipped Stone Tool category is represented by eighteen types.

D. INFERRED SURROUND McEwen (EdNf-22)

Location: The site runs along the west bank of Cottonwood Creek, and is completely disturbed. The site area consists primarily of stubble fields, some of which were plowed shortly before the survey was completed. The floodplain is very broad; and the north, northeast-facing slopes are well treed. Beaver dam/pond systems in 1986 were continuous throughout the area. By 1988 the tributary had become dry, and beaver had abandoned the area.

Site Character and Cultural Materials: Bone and FCR densities are highest where the serpentine nature of the creek forms an enclosed area or cul-de-sac. Lithic materials are scarce, consisting primarily of large quartzite and chert Flakes and Shatter. The high densities of bone materials in the enclosed areas suggests that these areas may have been used occasionally as a surround into which small bison herds were driven

TABLE 9: LITHIC ARTIFACT CLASSIFICATION: EdNf-3

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE														
Pressure/Retouch				16			7		9					16
Flakes and Fragment				179	5	24	73	4	48	3	2	20		179
Shatter Flakes & Blocks				10		2	7			1				10
Cores And Fragments				1				1						1
TOTAL				206	5	26	87	5	57	4	2	20		206
TOOLS SERIES	CLASS	SUBCLASS	Type											
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	13		3	7		2				1	
			Avonlea	1			1							
			Besant	12		1	7		2		2			
			Pelican Lake	3					3					
			McK/Dun/Han[4]	2	2									
		UNNOTCHED	Preform	5			1		4					
		FRAG		17		2	10		5					
	TOTAL			53		6	28		16		2		1	
	LATERAL	LARGE	Thick											
			Thin	1		1								
		SMALL	Thick	9		5	3		1					
			Thin	8			2		3	1	1		1	
			Preform	1			1							
		FRAG		19		6	6		2			3	2	
	TOTAL			38		12	12		6	1	1	3	3	
	TUBULAR			3			1		2					
TOTAL				94		18	41		24	1	3	3	4	94
UNIFACIAL POINTED														
	LATERAL	LARGE		1			1							
		SMALL	Thick	6			6							
			Thin	25		1	8		15		1			
		Spokeshave		3			3							
		FRAG		31		4	13		14					
	TOTAL			66		5	31		29		1			
	TUBULAR	PERFORATOR		5					5					
		INCISER		1			1							
	TOTAL			6			1		5					
	TRANSVERSE	LARGE												
		SMALL	Thick	24		2	12		9				1	
			Thin	30		2	13		14				1	
		FRAG		2			1		1					
	TOTAL			56		4	26		24				2	
TOTAL				128		9	58		58		1		2	128
TOTAL														222

COBBLE STONE INDUSTRY		DEBIT[5]	TOOLS	DEBIT	TOOLS
SERIES	CLASS				
SPALL	SURFACE	1	1	—	
	SECONDARY DEC[6]	1	1	—	
	FRAGMENTS				
TOTAL		2	2	2	2

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 10: ARTIFACT TYPE DISTRIBUTION: BY SITE: COTTONWOOD CREEK

CAMPSITES

Temporary

				Frequent Use 1	2	3	4	Infrequent Use 1	2	3	4	5	6
				CONFLUENCE	YOUNG I	YOUNG II	VOLKE I	LAX I	LAX II	LAX III	OLD WELL	VOLKE II	THOMPSON I
CHIPPED STONE INDUSTRY													
GENERAL DEBITAGE													
Pressure/Retouch													
Flakes and Fragment				X	X	X	X	X	X	X	X	X	X
Shatter Flakes & Blocks				X	X	X	X	X	X	X	X	X	X
Cores And Fragments				X		X	X		X		X		
TOOLS													
SERIES	CLASS	*SUBCLASS*	Type										
BIFACIAL	POINTED	*NOTCHED*	Historic										
			Plains/Prairie										
			Avonlea										
			Besant										
			Pelican Lake										
			McK/Dun/Han[1]										
			Oxbow										
			Mummy Cave										
			Lanceolate										
		UNNOTCHED	Preform										
		FRAG			X								
	LATERAL	*LARGE*	Thick										
			Thin										
		SMALL	Thick			X							
			Thin		X								
			Preform										
		FRAG											
	TUBULAR												
UNIFACIAL POINTED													
	LATERAL	*LARGE*											
		SMALL	Thick										
			Thin										
		Spokeshave	Frag										
		FRAG											
	TUBULAR	*Perforator*											
		Inciser											
	TRANSVERSE	*Large*											
		Small	Thick										
			Thin	X									
FCR				X	X	X	X	X	X	X	X	X	X
BONE				X	X	X	X	X	X		X	X	X
SHELL						X							
CERAMICS													
COBBLE STONE INDUSTRY													
SERIES	CLASS	Type											
COBBLE	UNMODIFIED	Hammerstone				X							
	GROUND	Pestle											
	CORE	Complex			X								
		End				X							
		Fragments					X						
SPALL	SURFACE			X		X			X	X			
	END												
	SECONDARY DEC[2]				X	X	X		X				
	FRAGMENTS								X	X			

ABBREVIATIONS:

1. McKean/Duncan/Hanna 2. Decortication

TABLE 10 cont: ARTIFACT TYPE DISTRIBUTION: BY SITE: COTTONWOOD CREEK

				CAMPSITES				
				Winter		Spring		
				1	2	1	2	3
				THOMPSON II	CAMPBELL I	EgNf 3	EgNf 5	EgNf 2
CHIPPED STONE INDUSTRY								
GENERAL DEBITAGE								
Pressure/Retouch				X		X		X
Flakes and Fragment				X	X	X	X	X
Shatter Flakes & Blocks				X	X	X	X	X
Cores And Fragments				X	X	X	X	X
TOOLS								
SERIES	CLASS	*SUBCLASS*	Type					
BIFACIAL	POINTED	*NOTCHED*	Historic				X	
			Plains/Prairie	X		X	X	X
			Avonlea	X		X	X	X
			Besant	X		X	X	X
			Pelican Lake			X	X	X
			McK/Dun/Han¹			X	X	X
			Oxbow				X	
			Mummy Cave				X	X
			Lanceolate				X	
		UNNOTCHED	Preform			X	X	X
		FRAG			X			
	LATERAL	*LARGE*	Thick				X	X
			Thin			X	X	
		SMALL	Thick			X	X	X
			Thin			X	X	X
			Preform			X	X	
		FRAG		X				
	TUBULAR						X	
UNIFACIAL POINTED							X	X
	LATERAL	*LARGE*				X	X	X
		SMALL	Thick	X		X	X	X
			Thin			X	X	X
		Spokeshave				X	X	
		FRAG						
	TUBULAR	*Perforator*				X	X	
		Inciser		X		X	X	X
	TRANSVERSE	*Large*					X	X
		Small	Thick	X		X	X	X
			Thin	X	X	X	X	X
FCR				X	X	X	X	X
BONE				X	X	X	X	X
SHELL								
CERAMICS						X	X	
COBBLE STONE INDUSTRY								
SERIES	CLASS	Type						
COBBLE	UNMODIFIED	Hammerstone						
	GROUND	Pestle			X			
	CORE	Complex						
		End						
		Fragments						
SPALL	SURFACE			X		X	X	X
	END							
	SECONDARY DEC²					X		X
	FRAGMENTS							

ABBREVIATIONS:

1. McKean/Duncan/Hanna 2. Decortication

WASCANA CREEK SITES (Fig 14)

A. INFERRED TEMPORARY CAMPSITES

1) EcNe-10

Location: The site is situated on the west side of Wascana Creek on the floodplain. The site area is under cultivation, and has also been heavily disturbed by a pipeline construction project.

Site Character: Cultural materials (bone) exhibited some clustering at the eastern edge of the site, adjacent to the creek. The site is generally associated with open conditions.

Cultural Materials: FCR; Bone; Core fragments; four Flakes (2 quartzite, 2 Swan River chert); one Scraper of Swan River chert; one Retouch Flake of quartz; one Biface. Shovel testing was carried out at the site (each ca. 40 cm in diameter). All 14 shovel tests were culturally sterile (Site Report; Sask. Archaeological Resource Record).

2) Valley Ranch II (EdNe-27)

Location: The site, located on the west side of the creek, is found in a rather intermediary position between the uplands and the valley bottom. It begins at about the first terrace and extends about midway up the slope. The site is also under cultivation.

Site Character: Artifact concentrations are greatest towards the slope edge. The site is generally associated with open conditions.

Cultural Materials: (Table 11): In the General Debitage category, chert has the highest frequency (65.7%), with the next highest frequency being quartz with 15.7%, and silicified peat with 10.5%. All Chipped Stone tools are fabricated from chert. The Chipped Stone Tool category is represented by only two artifact types (Table 35).

3) Grant III

Location: The site is located on the west side of the creek on the first terrace above the floodplain. The field is under cultivation.

Site Character: The site is not large, and is generally associated with open conditions. Artifact concentrations are greatest towards the stream edge.

Cultural Materials (Table 12): In the General Debitage category chert is the most common raw material, representing 69.7% of the assemblage. The General Debitage category reflects mainly initial and secondary lithic reduction activities. The Chipped Stone Tool category is represented by three tool types (Table 35). The Cobble Stone Industry is strongly represented by both tools and debitage.

4) Worona (EdNf-44)

Location: The site, on the west side of the tributary, is located on a terrace along the northeast-facing face of a valley spur. The site is fringed on the north by a large grove of poplars. The site was cultivated at one time, but is now grasslands.

Site Character: The site generally follows along the slope edge. Clusterings of FCR, Bone, and lithic debris dot the site area. The site location is mostly sheltered.

Cultural Materials: FCR; Bone; 18 Flakes (3 quartzite, 11 silicified peat, 4 chert); one Cobble Stone end core of quartzite; one Secondary Decortication Spall of quartzite.

5) Wascana Trails I (EdNf-35)

Location: The site is located on the floodplain, on the west side of the waterway in association with a northwest-facing slope. The area is highly disturbed, being part of the Wascana Trails Provincial Recreation Park, which is intersected with motorcycle trails.

Site Character: Site features are generally obscured because the area was seeded to grass. The site was found because it was located along a motorcycle trail, with cut banks exposing artifacts. The site area is generally associated with an open area.

Cultural Materials (Table 13): The assemblage exhibits the typical pattern of a

TABLE 11: LITHIC ARTIFACT CLASSIFICATION: Valley Ranch II (EdNe-27)

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE														
Flakes and Fragment				19		4	12	2	1					
Shatter Flakes & Blocks				15	2		10	3						
Cores And Fragments				4			3	1						
TOTAL				38	2	4	25	6	1					38
TOOLS														
SERIES	CLASS	*SUBCLASS*	Type											
UNIFACIAL POINTED														
	LATERAL	*LARGE*												
		SMALL	Thick	1			1							
			Thin											
		FRAG		1			1							
	TOTAL			2			2							
	TUBULAR	*PERFORATOR*												
		INCISER												
	TRANSVERSE	*LARGE*												
		SMALL	Thick											
			Thin	1			1							
		FRAG												
	TOTAL			1			1							
TOTAL				3			3							3
TOTAL														3

COBBLE STONE INDUSTRY		D[4]EBITS TOOLS		DEBITS TOOLS
SERIES	CLASS			
SPALL	SURFACE			
	END	1	1	—
	LATERAL			
	SECONDARY DEC[5]			
	FRAGMENTS	3	3	—
TOTAL		4	4	4

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. Debitage 5. Decortication

TABLE 12: LITHIC ARTIFACT CLASSIFICATION: Grant III

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Flakes and Fragment				23	2	4	16		1						—
Shatter Flakes & Blocks				9			6	3							—
Cores And Fragments				1			1								—
TOTAL				33	2	4	23	3	1						33
TOOLS															
SERIES	CLASS	*SUBCLASS*	Type												
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie												
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG													
	TOTAL														
	LATERAL	*LARGE*	Thick												
			Thin												
		SMALL	Thick												
			Thin												
			Preform												
		FRAG		1			1								—
	TOTAL			1			1								
TOTAL							1								1
UNIFACIAL	POINTED														
	LATERAL	*LARGE*													
		SMALL	Thick												
			Thin												
		FRAG		1			1								—
	TOTAL			1			1								
	TUBULAR	*PERFORATOR*													
		INCISER													
	TRANSVERSE	*LARGE*													
		SMALL	Thick	1			1								—
			Thin												
		FRAG													
	TOTAL			1			1								
TOTAL				2			2								2
TOTAL															3

COBBLE STONE INDUSTRY			DEBITS[5]	TOOLS			DEBITS	TOOLS
SERIES	CLASS	Type						
COBBLE	UNMODIFIED							
	SPLIT							
	CORE							
		Simple						
		Complex						
		End	1			1	—	
SPALL	SURFACE							
	END							
	LATERAL							
	SECONDARY DEC[6]			1		1	—	
	FRAGMENTS		2	1	2	1	—	
TOTAL			2	2	2	3	2	2

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 13: LITHIC ARTIFACT CLASSIFICATION: Wascana Trails I (EdNf-35)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY	FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE											
Pressure/Retouch											
Flakes and Fragment	16	1	8	3	2		2				
Shatter Flakes & Blocks	6	1		5							
Cores And Fragments						—					
TOTAL	22	2	8	8	2		2				22

TOOLS SERIES	CLASS	*SUBCLASS*	Type	FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie											
			Avonlea											
			Besant											
			Pelican Lake											
			McK/Dun/Han[4]											
UNIFACIAL	POINTED													
	LATERAL	*LARGE*												
		SMALL	Thick	1				1						
			Thin											
TOTAL				1				1						1

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	DEBIT[5]	TOOLS	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	DEBIT	TOOLS
COBBLE	UNMODIFIED														
	SPLIT														
	CORE														
		Simple													
		Complex	1		1									—	
		End													
SPALL	SURFACE			1	1									—	
	END														
	LATERAL														
	SECONDARY DEC[6]														
	FRAGMENTS														
TOTAL			1	1	2									1	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

high frequency of Chipped Stone Debitage, with chert as the predominant raw material. Chipped Stone tools and the Cobble Stone Industry again have about equal representation. The Chipped Stone Tool category is represented by one tool type (Table 35).

SPECIAL PURPOSE SITES

B. INFERRED OBSERVATION POST

1) EcNe-11

Location: The site is located on a ploughed upland field along the east side of the tributary, just above EcNe-10. It is also part of a pipeline construction area. Artifact materials are concentrated along the valley edge, and extend north from the pipeline.

Site Character: The site exhibited low density artifact clusterings consisting mainly of FCR, Shatter, and a very small amount of highly deteriorated bone.

Cultural Materials: When the site was previously surveyed in 1987, one Swan River Chert flake was collected. Left in situ during the 1988 survey were Bone, FCR, and lithic debitage, mostly initial reduction specimens.

2) Grant II (EdNf-46)

Location: The site is located on the west side of the creek on the valley uplands. The associated valley slope is very steep; and projects slightly into the valley, providing an excellent view of the tributary and surrounding uplands.

Site Character: The site generally follows along the valley rim; and exhibits the usual clusterings of FCR, Bone, and lithic debitage. Bone materials are not abundant; however, erosional activities on the uplands contribute to the disintegration of bone.

Cultural Materials (Table 14): The Chipped Stone Industry is poorly represented; only two tool types (Table 35). The Cobble Stone Industry dominates the assemblage in terms of both tools and debitage.

3) Beatty II (EdNf-43)

Location: This is a upland site located on the west side of the tributary. It is found on a slope which projects into the valley, giving a clear unrestricted view of the tributary to the north, south, and east. The area was once cultivated, but has been allowed to return to grasslands.

Site Character: Several clusterings of FCR, bone, and lithic debitage were found towards the valley edge.

Cultural Materials: Left in situ were FCR; Bone; 26 Flakes (9 silicified peat, 12 chert, 1 quartz, 3 quartzite, 1 shale); one Core fragment of silicified peat; one Complex Cobble core and fragment of quartzite.

4) Baker IV (EdNe-21)

Location: The site is situated on the immediate uplands on the east side of the tributary. A short distance to the south is a ravine entering the valley proper. The site is now under cultivation.

Site Character: The artifact materials tend to cluster along the valley rim for about 170 m in extent. Clusterings of FCR and lithic debris are found within the site parameters. Artifact tend to taper off at about 103 m from the valley rim.

Cultural Materials (Table 15): The General Debitage category indicates initial and secondary lithic reduction, with chert being the most common raw material, representing 65% of the sample, followed by silicified peat at 22.5%. The Chipped Stone Tool category had a poor representation, one tool type (Table 35).

5) Wascana Trails III (EdNf-37)

Location: The site is situated on the east side of the tributary on a valley spur. More specifically, the site begins on the uplands; and extends midway down the slope wall. The site's placement gives an unobstructed view of the valley on the north, south, and west. The

TABLE 14: LITHIC ARTIFACT CLASSIFICATION: Grant II (EdNf-46)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	*SILIC PEAT	CHERT	QUARTZ	*KRF	*SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				3			3								
Flakes and Fragment				3		1	2								
Shatter Flakes & Blocks															
TOTAL				6		1	5								6
TOTAL															
	LATERAL	LARGE	Thick												
			Thin												
		SMALL	Thick												
			Thin												
			Preform	1	1										
		FRAG													
TOTAL															
	TUBULAR														
TOTAL				1	1										1
UNIFACIAL POINTED															
	LATERAL	LARGE		1	1										
		SMALL	Thick												
			Thin												
		FRAG													
TOTAL				1	1										1
TOTAL				2	2										2

COBBLE STONE INDUSTRY			D*EBIT	TOOLS	QUARTZITE	*SILIC PEAT	CHERT	QUARTZ	*KRF	*SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL DEBIT	TOTAL TOOLS
SERIES	CLASS	Type														
COBBLE	UNMODIFIED															
	SPLIT															
	CORE															
		Simple														
		Complex	1		1										—	
		End														
SPALL	SURFACE			1										1	—	
	END															
	LATERAL															
	SECONDARY DEC*		1		1										—	
	FRAGMENTS		3	1	3									1	—	
TOTAL			5	2	5									2	5	2

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. Debitage 5. Decortication

TABLE 15: LITHIC ARTIFACT CLASSIFICATION: Baker - IV (EdNe-21)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY	FREQUENCY	& QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE											
Pressure/Retouch	21	2	5	13			1				
Flakes and Fragment	18	1	4	12	1						
Shatter Flakes & Blocks	1			1							
Cores And Fragments											
TOTAL	40	3	9	26	1		1				40

TOOLS SERIES	CLASS	SUBCLASS	Type	FREQUENCY	& QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
UNIFACIAL	POINTED													
	LATERAL	LARGE												
		SMALL	Thick	2			1					1		
			Thin											
		FRAG		1			1							
	TOTAL			3			2					1		
TOTAL														3

COBBLE STONE INDUSTRY SERIES	CLASS	DEBITS	TOOLS		DEBITS	TOOLS
SPALL	SURFACE	1	1	2	—	
	END					
	LATERAL					
	SECONDARY DEC[5]	2		2	—	
	FRAGMENTS					
TOTAL		3	1	4	3	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. Debitage 5. Decortication

site is situated on natural prairie.

Site Character: Artifact densities were low, but some clusterings of FCR and lithic debris did occur. Bone material was not observed; but the exposed nature of the site suggests that most fragments may have disintegrated.

Cultural Materials: (Table 16): General debitage almost exclusively dominates the assemblage.

C. INFERRED WINTER CAMPSITES

1) EcNe-6

Location: The site, registered in 1962, has an extremely broad designation; so that its specific location cannot be described. The contemporary survey suggests that the site is primarily located on a floodplain bounded on the south by the waterway, which in turn cuts a north-facing slope. From this area the site appears to extend east across the tributary to another floodplain.

Site Character: In both areas, artifact concentrations occur within the first 50 to 100 m from the stream edge. Bone is ubiquitous throughout the areas. FCR clusterings tended to be near the stream edge.

Cultural Materials (Table 17): Cultural materials associated with the General Debitage category were not collected. In the Chipped Stone Industry the range of tool types (eight) is large enough to imply a winter camp association (Table 35). Of the identifiable projectile points (20), Besant has the highest representation (70%), Pelican Lake is represented by 20%, while the Plains/Prairie side-notched point types make up the remaining 10%. A pestle and a maul, which have been designated as site furniture for a winter campsite, strongly support categorizing the site as a wintering area.

2) Sherwood Forest I sites

New Sites	Previously reported (Sask. Arch. Resource Record)
a) EdNe-24	d) EcNe-2 - not found
b) EcNe-20	e) EcNe-3 - may correlate with EcNe-20
c) EdNe-25	

Location: The sites, located on the floodplains of the tributary, are in a resort area consisting of a golf course, artifical lake, cottages, etc. In other words, the area is highly disturbed. These sites may be artifact concentrations representing a vast wintering area used repetitively for a long period of time. The total area extends at minimum 2.5 km along the waterway.

a) EdNe-24

Location: The artifacts were eroding out of a slope, which was part of a golf practice range.

Site Character: Indeterminate.

Cultural Materials: Bone, FCR; five Flakes (2 silicified peat, 1 quartz, 1 chert, 1 chalcedony); Pottery: 3 fragments.

b) EcNe-20

Location: The site is located on a broad floodplain adjacent to the waterway, where it cuts both northeast and northwest-facing slopes. The treed areas cross the waterway, extending for some distance into the site area. At present the area is used as a baseball field. There are also several cabins along the waterway.

Site Character: Cultural materials are found over a wide area; however, densities increase approaching the water's edge. Clusterings of FCR can also be seen.

Cultural Materials (Table 18): In the General Debitage Category, silicified peat has the highest representation with 52%, followed by chert with 18%. The Cobblestone

TABLE 16: LITHIC ARTIFACT CLASSIFICATION: Wascana Trails III (EdNf-37)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY	FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE											
Pressure/Retouch											
Flakes and Fragment	10	2	2	4	2						
Shatter Flakes & Blocks	8		1	3	4						
Cores And Fragments	1			1							
TOTAL	19	2	3	8	6						19

COBBLE STONE INDUSTRY			D⁴ E B I T	T O O L S		D E B I T	T O O L S
SERIES	CLASS	Type					
COBBLE	UNMODIFIED						
	SPLIT						
	CORE						
		Simple					
		Complex					
		End					
SPALL	SURFACE						
	END						
	LATERAL						
	SECONDARY DEC⁵						
	FRAGMENTS		2		2	2	
TOTAL							

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. Debitage 5. Decortication

TABLE 17: LITHIC ARTIFACT CLASSIFICATION: EcNe-6

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY

GENERAL DEBITAGE

TOOLS

SERIES	CLASS	SUBCLASS	Type	FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	2			2								
			Avonlea												
			Besant	14	1	1	7		2		3				
			Pelican Lake	4					4						
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG		10		1	5		4						
TOTAL				30	1	3	14		10		3				
	LATERAL	LARGE	Thick												
			Thin												
		SMALL	Thick	3	1	1	1								
			Thin	1		1									
			Preform	—											
		FRAG													
	TOTAL			4	1	2	1								
	TUBULAR														
TOTAL				4	1	2	1								4
UNIFACIAL POINTED															
	LATERAL	LARGE		—											
		SMALL	Thick	3			3								
			Thin	1					1						
		FRAG													
	TOTAL			4			3		1						
	TUBULAR	INCISER													
	TRANSVERSE	LARGE		1		1									
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL			1		1									
TOTAL				5	1	3		1							5
TOTAL															9

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	DEBIT[5]	TOOLS	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	DEBIT	TOOLS
COBBLE	GROUND	Maul	1	1	2									1		
		Pestle	1													
	SPLIT															
	CORE															
		Simple														
		Complex														
		End														
SPALL	SURFACE		2	2	4											
	END															
	LATERAL															
	SECONDARY DEC[6]															
	FRAGMENTS															
TOTAL			4	3	6									1	4	3

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 18: LITHIC ARTIFACT CLASSIFICATION: SHERWOOD FOREST I (EcNe-20)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE														
Pressure/Retouch														
Flakes and Fragment				40		18	7	2	8	2	1		2	
Shatter Flakes & Blocks				14		10	3	1						
TOTAL				54		28	10	3	8	2	1		2	54
TOOLS														
SERIES	CLASS	*SUBCLASS*	Type											
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie											
			Avonlea											
			Besant											
			Pelican Lake											
			McK/Dun/Han											
		UNNOTCHED	Preform											
		FRAG												
	TOTAL													
	LATERAL	*LARGE*	Thick											
			Thin											
		SMALL	Thick											
			Thin											
			Preform											
		FRAG												
	TOTAL													
	TUBULAR													
TOTAL														
UNIFACIAL	POINTED													
	LATERAL	*LARGE*												
		SMALL	Thick											
			Thin	2					2					
		FRAG		1					1					
	TOTAL			3					3					
	TUBULAR	*INCISER*												
	TRANSVERSE	*LARGE*												
		SMALL	Thick	1					1					
			Thin	2			1		1					
		FRAG												
	TOTAL			3			1		2					
TOTAL				6			1		5					6
TOTAL														6

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna

Industry is not represented, but it is highly probable that most large stones were removed from the site to facilitate baseball. Ceramics (3 fragments) support a residential base classification.

c) EdNe-25

Location: Artifacts are scattered along several roadways leading to cabins, and along a miniature golf course area. The associated slope faces east and northeast.

Site Character: Densities of cultural materials increase towards the stream edge. FCR occurs in clusterings, but bone is generally ubiquitous.

Cultural Materials: No materials were collected. FCR, Bone, and general debitage was observed in the site areas.

d) EcNe-2

The site was not located in the survey. There also were no artifact materials available from the site. The report (S.A.R.R.), however, states that flakes, points, an awl, a blade, and some sherds were recovered from the site.

e) EcNe-3

This previously designated site appears to correlate to some extent with EcNe-20. The site report (S.A.R.R.) states that artifacts of all types were recovered including an Agate Basin point. Some Ceramics were also collected.

3) Sherwood Forest II (EdNe-23)

Location: Artifacts were exposed when a wooded area on the floodplain was cleared, and excavated for a picnic area and road. The site was associated with a sheltered, heavily-wooded northwest-facing slope.

Site Character: There were high frequencies of bone scattered throughout the site area. FCR clusterings, Ceramics, and most lithic debitage were concentrated along the edge of the dry stream bed.

Cultural Materials (Table 19): The General Debitage category has representations in all its categories, suggesting that all stages of lithic manufacture and maintenance were carried out. Chert has the highest representation in the raw materials category (60%), followed by silicified peat with 26%. The range of Chipped Stone Tool types is five (Table 35). The presence of ceramics (12 sherds) also signifies a residential base. Burnt bone and shell fragments were also observed.

4) Bistretzan (EcNe-19)

Location: In the site area the waterway approaches the edge of an immense, northeast-facing slope, which is heavily wooded. The site, on the adjacent floodplain, extends from the waterway about 250 to 300 m. The field had just been plowed at time of survey.

Site Character: Although bone is generally ubiquitous, it reaches its highest concentrations within the first 100 m from the waterway edge. FCR clusterings are also mainly restricted to this area.

Lithic debris also has a rather broad distribution pattern, although it is most often found with the FCR clusterings.

Cultural Materials: Cultural materials, with one exception, were not collected. One bone tool, a flesher, was recovered from the site. Artifacts left in situ include Flakes, Shatter, Cores, Cobblestone Tools, and Debitage. In returning to the site a year later, after a dust storm, many artifacts were exposed: both Lateral and Transverse Unifaces; Besant points; and Large Bifaces. All cultural materials were left in situ.

5) Valley Ranch I (EdNe-26)

Location: The site is located on the floodplain in association with a treed,

TABLE 19: LITHIC ARTIFACT CLASSIFICATION: SHERWOOD FOREST II (EdNe-23)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				4		2	1					1			
Flakes and Fragment				51	1	13	30	2	5						
Shatter Flakes & Blocks				7		2	5								
Cores and Fragments				3			3								
TOTAL				65	1	17	39	2	5			1			65
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie												
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG													
	TOTAL														
	LATERAL	LARGE	Thick												
			Thin												
		SMALL	Thick												
			Thin												
			Preform												
		FRAG		2			1				1				
	TOTAL			2			1				1				
	TUBULAR			1							1				
TOTAL				3			1				2				3
UNIFACIAL POINTED															
	LATERAL	LARGE		1					1						
		SMALL	Thick	2			2								
			Thin	1			1								
		FRAG		2					2						
	TOTAL			6			3		3						
	TUBULAR	INCISER													
	TRANSVERSE	LARGE													
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL														
TOTAL				6			3		3						6
TOTAL															9

COBBLE STONE INDUSTRY			DEBITS[5]	TOOLS	QUARTZITE	SILIC PEAT	CHERT	QUARTZ	KRF	SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	DEBITS	TOOLS
SERIES	CLASS	Type														
COBBLE	UNMODIFIED															
	SPLIT															
	CORE															
		Simple	1		1										—	
		Complex	1		1										—	
		End														
SPALL	SURFACE			1										1	—	
	END															
	LATERAL															
	SECONDARY DEC[6]															
	FRAGMENTS		2		2										—	
TOTAL			4	1	4									1	4	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

northeast-facing slope. The site, situated in the area between the slope and the waterway, ranges from 60 to 180 m in width; and follows along approximately 1.0 river km of waterway. There are two coulees associated with the slope area.

Site Character: There are two broad artifact concentrations: one is located along the waterway edge in a relatively open area; the other is found along the sheltered slope edge. Bone materials are generally ubiquitous, but FCR tends to be restricted to these areas as well as General Debitage. Ceramics (two sherds) were found in proximity to the water's edge.

Cultural Materials (Table 20): The General Debitage reflects all stages of manufacture and maintenance. Chert is the preferred raw materials, representing 49.5% of the sample, followed by silicified peat at 28%, and KRF at 8%. The Chipped Stone Tool category is well represented; two types were recognized. Ceramics, although poorly represented, are also present.

6) Dunlop (EdNe-28)

Location: The site begins near the water's edge; then extends across the floodplain and midway up a low-gradient, northeast-facing slope. The slope is under cultivation. The site is large, extending approximately 375 m from the water's edge to mid-slope; and is about 275 m width (maximum).

Site Character: The site is unusual in that it appears to have a dual function: residential area and quarry. The slope has extensive outcrops of rocky till, which appear to have been quarried. Clusterings of FCR are numerous, but bone is scarce. Artifact concentrations occur at the slope base, and slightly higher. Although at the present the site is in an open area, prior to cultivation it may have had some treed areas.

Cultural Materials (Table 21): The artifact assemblage does not strongly reflect artifact types indicative of a winter campsite. No pressure/retouch flakes were recovered, nor were ceramics observed. In addition, in the Chipped Stone Tool category only six tool types were discerned; and bone materials were rare. However, the Cobble Stone Industry was strongly represented. Debitage associated with the above industry, i.e., Core and Spall fragments, Shatter, was extensive.

7) Grant I (EdNf-45)

Location: The site is directly associated with a heavily treed, northeast-facing slope. Its northern boundary is a dry stream bed. Site width ranges from approximately 125 to 250 m.

Site Character: Artifact concentrations occur along the edge of the dry stream bed, and along the sheltered slope. FCR is concentrated along the slope edge. One ceramic sherd was found in a FCR clustering.

Cultural Materials (Table 22): Artifact densities were not high. In the General Debitage category, pressure/retouch flakes were not discerned. Chert again is the preferred lithic material. In the Chipped Stone Tool Category six tool types were identified. The artifact assemblage only hints at a winter camp designation.

8) EdNf-12

Location: The site, situated on the east side of the creek, is situated on the first terrace above the valley bottom. It is bounded on the west and northeast by dry stream beds. The site extends for approximately 180 m (the extent of the plow zone) along the edge of the dry stream bed, situated on its northeast boundary. Its maximum visible width, perpendicular from the dry stream, is about 110 m. The site generally lies in exposed conditions; however, it may extend into more sheltered areas, which at the present are covered with natural prairie.

Site Character: Most cultural materials, primarily FCR, reach their greatest concentrations in proximity to the dry stream bed along the site's northern boundary.

Cultural Materials (Table 23): All Debitage classes are represented, with chert

TABLE 20: LITHIC ARTIFACT CLASSIFICATION: VALLEY RANCH I (EdNe-26)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE														
Pressure/Retouch				14		1	7	1	5					
Flakes and Fragment				145	10	43	70	7	11	2			2	
Shatter Flakes & Blocks				34	4	9	19		1				1	
Cores and Fragments				1		1								
TOTAL				194	14	54	96	8	17	2			3	194
TOOLS														
SERIES	CLASS	*SUBCLASS*	Type											
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie	2			1			1				
			Avonlea											
			Besant	1			1							
			Pelican Lake											
			McK/Dun/Han[4]											
			Other	1			1							
		UNNOTCHED	Preform											
		FRAG												
	TOTAL			4			3			1				
	LATERAL	*LARGE*	Thick	2			2							
			Thin	1		1								
		SMALL	Thick	1					1					
			Thin											
			Preform	1							1			
		FRAG		1		1								
	TOTAL			6		2	2		1		1			
	TUBULAR													
TOTAL				10		2	5		1	1	1			10
UNIFACIAL POINTED														
	LATERAL	*LARGE*		—										
		SMALL	Thick											
			Thin	2					2					
		FRAG		1					1					
	TOTAL			3					3					
	TUBULAR	*INCISER*												
	TRANSVERSE	*LARGE*		1			1							
		SMALL	Thick	1					1					
			Thin	4			2		2					
		FRAG												
	TOTAL			6			3		3					
TOTAL				9			3		6					9
TOTAL														19

COBBLE STONE INDUSTRY			DEBIT[5] TOOLS		DEBIT TOOLS
SERIES	CLASS	Type			
COBBLE	UNMODIFIED				
	CORE	Simple			
		Complex			
		End			
SPALL	SURFACE		1	1	—
	END		1	1	—
	LATERAL				
	SECONDARY DEC[6]		2	2	—
	FRAGMENTS				
TOTAL			4	4	4

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 21: LITHIC ARTIFACT CLASSIFICATION: DUNLOP (EdNe-28)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY

				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Flakes and Fragment				38	1	3	32		1				1		
Shatter Flakes & Blocks				8	1		5	1					1		
Cores and Fragments				2		1	1								
TOTAL				48	2	4	38	1	1				2		48
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie												
			Avonlea												
			Besant	1					1						
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG													
	TOTAL			1											
	LATERAL	LARGE	Thick	1	1										
			Thin												
		SMALL	Thick												
			Thin												
			Preform	1			1								
		FRAG		1		1									
	TOTAL			3	1	1	1								
	TUBULAR														
TOTAL				4	2	1	1								4
UNIFACIAL POINTED															
	LATERAL	LARGE													
		SMALL	Thick	2		1	1								
			Thin	4		1			3						
		FRAG		1			1								
	TOTAL			7		2	2		3						
	TUBULAR	INCISED													
	TRANSVERSE	LARGE													
		SMALL	Thick												
			Thin	1						1					
		FRAG													
	TOTAL			1						1					
TOTAL				8		2	2		3	1					8
TOTAL															12

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	DEBITS[5]	TOOLS											DEBITS	TOOLS
COBBLE	UNMODIFIED	Hammerstone														
	Ground	Maul		1	1										—	
	CORE	Simple														
		Complex	1		1										—	
		End	1		1										—	
SPALL	SURFACE			2	2										—	
	END		2	1	2									1	—	
	LATERAL															
	SECONDARY DEC[6]		2	1	2									1	—	
	FRAGMENTS		2		2										—	
TOTAL			8	5	11									2	8	5

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 22: LITHIC ARTIFACT CLASSIFICATION: GRANT I (EgNf-45)

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITES	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
				LITHIC TYPE DISTRIBUTION										
GENERAL DEBITAGE														
Flakes and Fragment				23		3	16	1	3					
Shatter Flakes & Blocks				8		2	4	2						
Cores and Fragments				1			1							
TOTAL				32		5	21	3	3					32
TOOLS														
SERIES	CLASS	*SUBCLASS*	Type											
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie											
			Avonlea											
			Besant											
			Pelican Lake											
			McK/Dun/Han[4]											
		UNNOTCHED	Preform											
		FRAG		2			1				1			
	TOTAL			2			1				1			
	LATERAL	*LARGE*	Thick											
			Thin											
		SMALL	Thick	2		1	1							
			Thin											
			Preform	1							1			
		FRAG												
	TOTAL			3		1	1				1			
	TUBULAR													
TOTAL				5		1	2				2			5
UNIFACIAL POINTED														
	LATERAL	*LARGE*		1	1									
		SMALL	Thick	1			1							
			Thin											
		FRAG												
	TOTAL			2	1		1							
	TUBULAR	*INCISER*												
	TRANSVERSE	*LARGE*												
		SMALL	Thick											
			Thin	1			1							
		FRAG												
	TOTAL			1			1							
TOTAL				3	1		2							3
TOTAL														8

COBBLE STONE INDUSTRY			D[5]EBITS	TOOLS	DEBITS	TOOLS
SERIES	CLASS	Type				
SPALL	SURFACE					
	END					
	LATERAL					
	SECONDARY DEC[6]					
	FRAGMENTS		1	1	2	

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 23: LITHIC ARTIFACT CLASSIFICATION: EdNf-12

				LITHIC TYPE DISTRIBUTION											
CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				7			5		2						
Flakes and Fragment				85	4	31	32	6	7	3	2				
Shatter Flakes & Blocks				23		7	12	1	3						
Cores and Fragments				10	1	3	5			1					
TOTAL				125	5	41	54	7	12	4	2				125
TOOLS															
SERIES	CLASS	*SUBCLASS*	Type												
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie												
			Avonlea												
			Besant												
			Pelican Lake	1			1								
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG													
	TOTAL			1											
	LATERAL	*LARGE*	Thick												
			Thin												
		SMALL	Thick												
			Thin												
			Preform	—											
		FRAG													
	TOTAL														
	TUBULAR														
TOTAL															1
UNIFACIAL POINTED				1			1								
	LATERAL	*LARGE*		—											
		SMALL	Thick	3			3								
			Thin												
		FRAG		3			1		2						
	TOTAL			6			4		2						
	TUBULAR	*INCISER*													
	TRANSVERSE	*LARGE*													
		SMALL	Thick												
			Thin	4			2		2						
		FRAG													
	TOTAL			4			2		2						
TOTAL				11			7		4						11
TOTAL															12

COBBLE STONE INDUSTRY			DEBIT[5]	TOOLS		DEBIT	TOOLS
SERIES	CLASS	Type					
COBBLE	UNMODIFIED	Hammerstone	1	1		—	
	SPLIT						
	CORE						
		Simple					
		Complex					
		End					
SPALL	SURFACE		1	1		—	
	END		1		1	—	
	LATERAL						
	SECONDARY DEC[6]					—	
	FRAGMENTS		1	1			
TOTAL			1 3	3	1	1	3

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

again exhibiting the highest raw material frequency (43%), followed by silicified peat at 33%, then KRF with 10%.

The only point type distinguished in the artifact collection was Pelican Lake; however, the site report (S.A.R.R.) also listed Agate Basin and Plains Side-notched as being represented on the site. A maul and some bifaces were also recovered, and were included in the site analysis. The range of Chipped Stone Tool types was not high, only seven; but ceramics were also part of the assemblage. The artifact collection generally supports a winter camp designation; however, the exposed nature of the site is problematic. But then, as previously noted, the site may extend into a more sheltered area; a factor that still needs to be tested.

9) Baker I (EdNf-38)

Location: The site is located on the first terrace just above the floodplain; and is associated, on its southern edge, with a dry stream bed. It is directly below the spring campsite EdNf-39. It is also associated with a treed east-facing slope. At one time it was a cultivated field, but has reverted to grasslands.

Site Character: Artifacts are difficult to discern, but appear to be concentrated along the dry stream bed. The artifact recovery was primarily from an eroding wall of a dry stream bed.

Cultural Materials (Table 24): All categories are presented in the General Debitage category. Chert and silicified peat are equally represented, 38% and 37% respectively, in the raw materials category. The Chipped Stone tools are poorly represented; only two. The designation of winter campsite is based on several other factors: location in a sheltered area; the presence of ceramics; the recovery of pressure/retouch flakes; and association with a large winter campsite configuration directly across the waterway at Baker III.

10) Baker III sites

Location: These sites are part of a large winter campsite configuration located on the east side of the tributary. It includes a kill site and two campsite areas that were kept separate because they appear to focus on different activities. On the south, Baker IIIa is bounded by a treed, northwest-facing slope. On the north it lies along a low-lying area that has a dry stream bed, and an inner area that may have been a lake and/or swamp. Baker IIIb has the low-lying area on its southern boundary; while on the west it runs along a dry stream bed. The main site area lies on a low gradient slope that has high concentrations of till, which is reflected in the artifact assemblage. Baker IIIc lies south from area IIIa, towards a ravine entering the valley proper. Areas a and b are under cultivation, while area c is a hay meadow.

a) Baker IIIa (EdNf-40)

Site Character: Within the site area defined by the plow zone, Bone and General Debitage are generally ubiquitous. Clusterings of FCR do tend to occur more frequently towards the slope edge. The cultivated areas is approximately 210 by 150 m.

Cultural Materials (Table 25): The artifact assembly provides strong evidence for a winter campsite designation: a wide range of Chipped Stone tool types (11); the presence of site furniture, a maul; and evidence of pressure/retouch flakes. Artifact densities were high and relatively uniform. Ceramics, however, were poorly represented; only five specimens. Diagnostics, however, indicate that the site is primarily a Besant occupation, which is rarely associated with high frequencies of Ceramics. In the General Debitage class, chert is the preferred raw material (53%), followed by silicified peat (22%), then KRF with 9%.

TABLE 24: LITHIC ARTIFACT CLASSIFICATION: BAKER I (EdMf-38)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY

GENERAL DEBITAGE	FREQUENCY	QUARTZITE	'SILIC PEAT	CHERT	QUARTZ	'KRF	'SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
Pressure/Retouch	12		3	7		2						
Flakes and Fragment	67	5	25	24	5	2	4	2				
Shatter Flakes & Blocks	20	3	9	7	1							
Cores and Fragments												
TOTAL	99	8	37	38	6	4	4	2				99

TOOLS

SERIES	CLASS	SUBCLASS	Type	FREQUENCY	QUARTZITE	'SILIC PEAT	CHERT	QUARTZ	'KRF	'SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie												
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han*												
		UNNOTCHED	Preform												
		FRAG													
	TOTAL														
	LATERAL	*LARGE*	Thick												
			Thin												
		SMALL	Thick	1		1									
			Thin												
			Preform	—											
		FRAG													
	TOTAL														
	TUBULAR														
TOTAL				1		1									1
UNIFACIAL POINTED															
	LATERAL	*LARGE*		—											
		SMALL	Thick												
			Thin												
		FRAG		3		1	2								
	TOTAL														
	TUBULAR	*INCISER*													
	TRANSVERSE	*LARGE*													
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL														
TOTAL				3		1	2								3
TOTAL															4

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	D*EBITS	TOOLS	QUARTZITE	'SILIC PEAT	CHERT	QUARTZ	'KRF	'SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	DEBITS	TOOLS
COBBLE	UNMODIFIED	Hammerstone		1	1										—	
	SPLIT															
	CORE															
		Simple														
		Complex														
		End	1		1										—	
SPALL	SURFACE															
	END															
	LATERAL															
	SECONDARY DEC*		3		2									1	—	
	FRAGMENTS		1		1										—	
TOTAL			5	1	5									1	5	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 6. Debitage 7. Decortication

TABLE 25: LITHIC ARTIFACT CLASSIFICATION: BAKER IIIa (EdNf-40)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				12		2	6		4						
Flakes and Fragment				79	4	16	39	7	6	3			4		
Shatter Flakes & Blocks				16		5	11								
Cores and Fragments				4		1	3								
TOTAL				111	4	24	59	7	10	3			4		111
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	1			1								
			Avonlea												
			Besant	4		1	2				1				
			Pelican Lake												
			McK/Dun/Han⁴												
			Other	1			1								
		UNNOTCHED	Preform	1			1								
		FRAG													
	TOTAL			7		1	5				1				
	LATERAL	LARGE	Thick												
			Thin												
		SMALL	Thick	2		1	1								
			Thin	2		1	1								
			Preform												
		FRAG		5		2	3								
	TOTAL			9		4	5								
	TUBULAR														
TOTAL				16		5	10				1				16
UNIFACIAL POINTED															
	LATERAL	LARGE													
		SMALL	Thick	5		1	4								
			Thin	2			2								
		FRAG													
	TOTAL			7		1	6								
	TUBULAR	PERFORATOR		1			1								
	TRANSVERSE	LARGE													
		SMALL	Thick	4			3						1		
			Thin	2			1		1						
		FRAG													
	TOTAL			6			4		1				1		
TOTAL				14		1	11		1				1		14
TOTAL				30											30

COBBLE STONE INDUSTRY			DEBIT	TOOLS	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	DEBIT	TOOLS
SERIES	CLASS	Type														
COBBLE	UNMODIFIED	Hammerstone		1	1											
	GROUND	Maul		1										1		
	CORE	Simple														
		Complex														
		End	2		2											
SPALL	SURFACE		1	2	2									1		
	END															
	LATERAL															
	SECONDARY DEC⁶			1	1											
	FRAGMENTS		1		1											
TOTAL			4	5	7									2	4	5

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3 Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

b) Baker IIIb (EdNf-41)

Site Character: The site features are obscured by the large amount of till deposit in the eastern portion of the site. Debris associated with the Cobble Stone Industry is also high. Artifacts, however, do appear to cluster along the dry stream bed on the western boundary of the site.

Cultural Materials (Table 26): The artifact assemblage does hint at a winter camp tool kit. Pressure/retouch flakes are present as well as a reasonable range of Chipped Stone tool types; i.e., seven. The presence of a perforator also attests to activities such as skin working, which require greater duration of stay. Ceramics are present; however, the sample is limited to one sherd. The unusual feature is the high representation in the Cobble Stone Industry. It appears that some quarrying was being carried out at the site. Again, chert has the highest frequency in the General Debitage with 41%, followed by silicified peat with 24%, then quartz with 11%.

c) Baker IIIc (EdNf-42)

Site Character: The site is generally obscured being a hay meadow. Artifact recovery was mostly along a roadside. Two test pits in the area indicated high densities of butchered bison bone.

Cultural Materials (Table 27): The sample is too small for any conclusive inferences. From test pit I the following artifacts were recovered: Bone, FCR, Charcoal, Burnt bone, Flakes and Fragments, a Lateral Biface fragment, and a single potsherd. Bone continued to 35 cm. In test pit 2, FCR, Bone, Flakes, and fragments were recovered. It is inferred that Baker IIIc is most likely a bison kill area.

11) Martin (EdNf-34)

Location: The site is located on the floodplain, on the east side of the tributary. The site's southern boundary runs along a treed northwest-facing slope. Its southern boundry is a dry stream bed. Another dry stream bed intersects the site.

Site Character: Although just freshly plowed, the site area appeared to have two artifact concentrations; one along the dry stream bed to the north, and one along the slope edge.

Cultural Materials (Table 28): Chert was the preferred raw material in the General Debitage category with 47%, followed by silicified peat with 35%. The condition of the site, being recently plowed, affected artifact recovery. No pressure/retouch flakes were observed, and most of the Chipped Stone tools were from the large categories. Chipped Stone Tool types totalled six (Table 35).

12) Gilmore II (EdNe-22)

Location: The site is situated on the floodplain on the east side of the creek. It is bounded on the south by a northeast-facing slope, and on the north by the dry stream bed of a small tributary. It is approximately 250 m in length, and 100 m wide at its maximum point. The field was normally in crop; but due to the drought was used as a pasture, resulting in extensive disturbance by cattle and horses.

Site Character: There are many clusterings of FCR, but they reach their highest concentrations along both the slope wall and the stream edge. Bone is generally ubiquitous on the site.

Cultural Materials (Table 29): The General Debitage has representation in all categories. Chert has the highest frequency in the raw materials category (38%), followed by KRF (23%), then silicified peat with 18%. Diagnostics include one point type; i.e., Avonlea. The artifact assemblage strongly suggests a winter camp: there is a significant range of Chipped Stone Tool types (10); and ceramics are well represented (25 sherds). However, the Avonlea point type generally is associated with substantial amounts of ceramics.

TABLE 26: LITHIC ARTIFACT CLASSIFICATION: BAKER IIIb (EdNf-41)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				5		1	2		2						
Flakes and Fragment				40	2	11	17	6	4						
Shatter Flakes & Blocks				22		5	8	6	2					1	
Cores and Fragments				3			2			1					
TOTAL				70	2	17	29	12	8	1				1	70
TOOLS															
SERIES	CLASS	*SUBCLASS*	Type												
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie												
			Avonlea												
			Besant	1						1					
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform	1			1								
		FRAG		2			2								
	TOTAL			4			3			1					
	LATERAL	*LARGE*	Thick												
			Thin	1		1									
		SMALL	Thick	2			2								
			Thin												
			Preform	—											
		FRAG													
	TOTAL			3		1	2								
	TUBULAR														
TOTAL				7		1	5			1					7
UNIFACIAL POINTED															
	LATERAL	*LARGE*													
		SMALL	Thick												
			Thin	4		1	2		1						
		FRAG													
	TOTAL			4		1	2		1						
	TUBULAR	*PERFORATOR*		1				1							
	TRANSVERSE	*LARGE*		1			1								
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL			1			1								
TOTAL				6		1	3	1	1						6
TOTAL				13											13

COBBLE STONE INDUSTRY			DEBIT[5]	TOOLS	QUARTZITE	OTHER	DEBITS	TOOLS
SERIES	CLASS	Type						
COBBLE	UNMODIFIED	Hammerstone		1	1			
	CORE	Simple						
		Complex						
		End						
SPALL	SURFACE		3	1	5	1		
	END							
	LATERAL							
	SECONDARY DEC[6]		2		2			
	FRAGMENTS							
TOTAL			5	6	10	1	5	6

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 27: LITHIC ARTIFACT CLASSIFICATION: BAKER IIIc (EdNf-42)

CHIPPED STONE INDUSTRY	FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE											
Pressure/Retouch											
Flakes and Fragment	12	2	4	5		1					
Shatter Flakes & Blocks	2		1	1							
TOTAL	14	2	5	6		1					14

TOOLS SERIES	CLASS	SUBCLASS	Type	FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
BIFACIAL	POINTED	NOTCHED	Plains/Prairie											
		UNNOTCHED	Preform	1		1								
UNIFACIAL	POINTED													
	LATERAL	LARGE												
		SMALL	Thick											
			Thin	1					1					
TOTAL														2

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood

TABLE 28: LITHIC ARTIFACT CLASSIFICATION: MARTIN (EdNf-34)

CHIPPED STONE INDUSTRY				LITHIC TYPE DISTRIBUTION										
				FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE.														
Pressure/Retouch														
Flakes and Fragment				34	2	12	15	1		1	1		2	
Shatter Flakes & Blocks				19	2	7	9	1						
Cores and Fragments				4		1	3							
TOTAL				57	4	20	27	2		1	1		2	57
TOOLS														
SERIES	CLASS	SUBCLASS	Type											
BIFACIAL	POINTED	NOTCHED	Plains/Prairie											
			Avonlea											
			Besant											
			Pelican Lake											
			McK/Dun/Han⁴											
		UNNOTCHED	Preform											
		FRAG		1			1							
	TOTAL			1			1							
	LATERAL	LARGE	Thick	1							1			
			Thin											
	TOTAL			1										
TOTAL				2			1				1			2
UNIFACIAL POINTED														
	LATERAL	LARGE		1										
		SMALL	Thick	1			1							
			Thin	1			1							
	TOTAL			3			2							
	TUBULAR	INCISER												
	TRANSVERSE	LARGE		1			1							
	TOTAL			1			1							
TOTAL				4			3							4
TOTAL				6										6

COBBLE STONE INDUSTRY			⁵DEBITS	TOOLS	QUARTZITE		DEBITS	TOOLS
SERIES	CLASS	Type						
COBBLE	UNMODIFIED							
	SPLIT							
	CORE							
		Simple						
		Complex						
		End	1		1			
SPALL	SURFACE			1	1			
	END							
	LATERAL							
	SECONDARY DEC⁶							
	FRAGMENTS							
TOTAL			1	1	1		1	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 29: LITHIC ARTIFACT CLASSIFICATION: GILMORE II (EdNe-22)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
GENERAL DEBITAGE														
Pressure/Retouch				19			6		12	1				
Flakes and Fragment				48	8	15	17	1	7					
Shatter Flakes & Blocks				13	3		6			4				
Cores and Fragments				2			2							
TOTAL				82	11	15	31	1	19	5				82
TOOLS														
SERIES	CLASS	SUBCLASS	Type											
BIFACIAL	POINTED	NOTCHED	Plains/Prairie											
			Avonlea	1			1							
			Besant											
			Pelican Lake											
			McK/Dun/Han[4]											
		UNNOTCHED	Preform	1			1							
		FRAG		1			1							
	TOTAL			3			3							
	LATERAL	LARGE	Thick	1		1								
			Thin											
		SMALL	Thick	1			1							
			Thin											
			Preform											
		FRAG												
	TOTAL			2		1	1							
	TUBULAR													
TOTAL				5		1	4							5
UNIFACIAL	POINTED			2					1		1			
	LATERAL	LARGE												
		SMALL	Thick	1			1							
			Thin	1							1			
		FRAG												
	TOTAL			2			1				1			
	TUBULAR	INCISER	Thick	1							1			
	TRANSVERSE	LARGE												
		SMALL	Thick	1		1								
			Thin	4			2		2					
		FRAG												
	TOTAL			5		1	2		2					
TOTAL				10		1	3		3		3			10
TOTAL														15

COBBLE STONE INDUSTRY			DEBIT[6]	TOOLS	QUARTZITE	TOTAL DEBIT	TOTAL TOOLS
SERIES	CLASS	Type					
COBBLE	UNMODIFIED						
	SPLIT						
	CORE	Simple					
		Complex	1		1	—	
		End					
SPALL	SURFACE			1	1	—	
	END						
	LATERAL						
	SECONDARY DEC[7]						
	FRAGMENTS			1	1	—	
TOTAL			1	2	3	1	2

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 6. Debitage 7. Decortication

13) Gilmore I (EdNf-11)

Location: The campsite area is bounded on the east by the comtemporary Wascana Creek, and on the west by a dry stream bed that runs along a norhtwest-facing slope. The kill site is located on a terrace on the east side of the dry stream bed. The contemporary creek had eroded away a significant part of the campsite area.

Site Character: The campsite area has been under cultivation for many years. Artifact densities, particularly ceramics, tend to increase towards the edge of the dry stream bed. Artifact densities are high, and bone is ubiquitious through the area. FCR also is abundant.

Cultural Materials: (Table 30) The General Debitage has representation in all categories, with chert having the highest frequency (51%), followed by silicified peat (20%), then KRF (14%). The Plains/Prairie Side-notched is the only point type recovered from the campsite area. This site best examplifies the characteristics attributed to a winter campsite. Fourteen Chipped Stone Tool types were identified in the artifact assemblage (Table 35). Unnotched and notched point types were equally represented. Site furniture, e.g., mauls and ceramics, are present. Ceramics, in particular, are abundant; 364 sherds were recovered. What was particularly significant was the high frequency of Cobble Stone Tools in the assemblage, implying that butchering was an important activity.

Excavations were carried out in the kill area by the University of Regina during 1982 and 1984. For both years, recovered lithic artifacts totalled 13, of which 10 were points, two were flakes, and one was a core. One bone awl was also found. The faunal remains were almost exclusively bison, with the exception of a few canid specimens.

D) INFERRED SPRING CAMPSITES

1) Baker II (EdNf-39)

Location: The site is located on the west side of the creek on the prairie uplands. It is highly disturbed, being part of a farmyard complex which includes buildings, garden, road, etc. The site provides an excellent view of the valley; and extends for a minimum of 400 m along the valley rim. It also extends perpendicularly from the valley edge about 60 m. Just below in the valley bottom is Baker I (EdNf-38), which has been designated a winter campsite.

Site Character: Clusterings of FCR dot the site, with the greatest concentrations towards the valley rim. Bone is generally ubiquitous, but highly disintegrated.

Cultural Materials (Table 31): In the General Debitage Category all categories are represented, reflecting all stages of manufacture and maintenance. Chert is the preferred raw material, representing 49% of the sample, followed by silicified peat with 24%, and KRF with 11%. Only one point type was recovered, the Plain/Prairie Side-notched. Ten Chipped Stone tool types were distinguished (Table 35). The Cobble Stone Industry is well represented, but restricted to the spall series.

2) EdNf-13

Location: This site, on the uplands, was first reported in 1971; and the site designation located it several 100 meters farther north of EdNf-39. It is highly likely that both sites are part of a large spring residential base. The site area is partly natural prairie, but also part of a large farmyard and garden.

Site Character: Artifact concentrations are greatest towards the valley rim.

Cultural Material (Table 32): The General Debitage category is poorly represented, most likely deliberately left in situ by the collector. Additional artifact materials that are important are ceramics; and also the identification of an additional point type- Besant. Four Chipped Stone Tool types were identifed (Table 35).

TABLE 30: LITHIC ARTIFACT CLASSIFICATION: GILMORE I (EdNe-11)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	¹SILIC PEAT	CHERT	QUARTZ	²KRF	³SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				39		7	14		14		4				
Flakes and Fragment				362	10	66	185	8	54		28	1	2	8	
Shatter Flakes & Blocks				55	3	14	32	2	3		1				
Cores and Fragments				23	1	8	14								
TOTAL				479	14	95	245	10	71		33	1	2	8	479
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	7			4		1		1		1		
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han⁴												
		UNNOTCHED	Preform	7		1	5			1					
		FRAG		8		3	3		1		1				
	TOTAL			22		4	12		2	1	2		1		
	LATERAL	LARGE	Thick	3	1	1	1								
			Thin	1			1								
		SMALL	Thick	7		2	3		1			1			
			Thin	2		1					1				
			Preform	—											
		FRAG		4		4									
	TOTAL			17	1	8	5		1		1	1			
	TUBULAR			1									1		
TOTAL				40	1	12	17		3	1	3	1	2		40
UNIFACIAL	POINTED			1			1								
	LATERAL	LARGE		5	1		2		1				1		
		SMALL	Thick	3			2		1						
			Thin	12		1	6		5						
		FRAG		15			8		7						
	TOTAL			35	1	1	18		14					1	
	TUBULAR	INCISER													
	TRANSVERSE	LARGE		1			1								
		SMALL	Thick	8			5		3						
			Thin	12		1	3		7		1				
		FRAG													
	TOTAL			21		1	9		10		1				
TOTAL				57	1	2	28		24		1			1	57
TOTAL															97

COBBLE STONE INDUSTRY			D⁵EBITS	TOOLS			DEBITS	TOOLS
SERIES	CLASS	Type						
COBBLE	UNMODIFIED	Hammerstone		5	4	1		
	GROUND	Maul		2	2			
	SPLIT			2		2		
	CORE	Simple	1			1		
		Complex	2	1	1	2		
		End	3		3			
SPALL	SURFACE		1	2	2			
	END			1	1			
	LATERAL							
	SECONDARY DEC⁶		7	2	7	2		
	FRAGMENTS		13		10	3		
TOTAL			27	15	31	11	27	15

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 31: LITHIC ARTIFACT CLASSIFICATION: BAKER II (EgNf-39)

CHIPPED STONE INDUSTRY					LITHIC TYPE DISTRIBUTION										
				FREQUENCY	QUARTZITE	SILIC PEAT[1]	CHERT	QUARTZ	KRF[2]	SILIC WOOD[3]	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Pressure/Retouch				14			6		8						
Flakes and Fragment				125	7	33	55	4	12	4	2		8		
Shatter Flakes & Blocks				57		14	34	3	2	4					
Cores and Fragments				5		2	3								
TOTAL				201	7	49	98	7	22	8	2		8		201
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie	1									1		
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform	1			1								
		FRAG													
	TOTAL			2			1						1		
	LATERAL	LARGE	Thick	2			2								
			Thin												
		SMALL	Thick												
			Thin	1				1							
			Preform												
		FRAG													
	TOTAL			3			2	1							
	TUBULAR														
TOTAL				5			3	1					1		5
UNIFACIAL POINTED															
	LATERAL	LARGE		1		1									
		SMALL	Thick	2			2								
			Thin	2			1		1						
		SPOKESHAVE		1			1								
		FRAG		1		1									
	TOTAL			7		2	4		1						
	TUBULAR	INCISER													
	TRANSVERSE	LARGE													
		SMALL	Thick	2			2								
			Thin	2			2								
		FRAG													
	TOTAL			4			4								
TOTAL				11		2	8		1						11
TOTAL															16

COBBLE STONE INDUSTRY			DEBIT[5]	TOOLS		DEBIT	TOOLS
SERIES	CLASS	Type					
COBBLE	UNMODIFIED						
	SPLIT						
	CORE						
		Simple					
		Complex					
		End					
SPALL	SURFACE		2	2			
	END		2	1	1		
	LATERAL						
	SECONDARY DBC[6]		1		1		
	FRAGMENTS		1	1			
TOTAL			6	4	2		6

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 32: LITHIC ARTIFACT CLASSIFICATION: EdNf-13

CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	TOTAL
				LITHIC TYPE DISTRIBUTION										
GENERAL DEBITAGE														
Pressure/Retouch														
Flakes and Fragment				7	1		4	1				1		
Shatter Flakes & Blocks														
TOTAL				7										7
TOOLS														
SERIES	CLASS	*SUBCLASS*	Type											
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie											
			Avonlea											
			Besant	1					1					
			Pelican Lake											
			McK/Dun/Han[4]											
		UNNOTCHED	Preform											
		FRAG												
	TOTAL			1					1					
TOTAL				1					1					1
UNIFACIAL POINTED														
	LATERAL	*LARGE*												
		SMALL	Thick	1			1							
			Thin	1							1			
		FRAG												
	TOTAL			2			1				1			
	TUBULAR	*INCISER*												
	TRANSVERSE	*LARGE*												
		SMALL	Thick											
			Thin	1			1							
		FRAG												
	TOTAL			1			1							
TOTAL				3			2				1			3
TOTAL														4

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna

E) NON-CLASSIFIED SITES

1) Wascana Trails II (EdNf-36)

Location: The site is located on the west side of the tributary on the floodplain. It follows along the eastern side of a valley spur. Site conditions are generally quite open. The site is extensively disturbed, being part of a motorcycle trail. Most of the site is obscured by grass.

Site Character: Artifact materials were mainly recovered along a trail which exposed materials.

Cultural Materials (Table 33): In the General Debitage category, silicified peat has the highest frequency with 39%, followed by chert with 28%. Tool types in the Chipped Stone Industry total five. The presence of a perforator hints at winter occupation; however, evidence is generally insufficient.

2) EcNe-1

Location: The site extends from the lower to middle levels of a low gradient slope on the west side of the waterway. A golf course now covers the northern part of the site area. The rest is a cultivated field. The site area was first surveyed in 1961.

Site Character: The site is highly disturbed so that very few specific features could be discerned. Its importance lies in its close proximity to a series of large sites on the floodplain and lower terraces which occupy both sides of the tributary. It may be a southern extension of this vast archaeological configuration; i.e., relate to the Sherwood Forest sites.

Cultural Materials: One Historic metal point; two Lateral Bifaces (1 silicified peat, 1 chert); one shell pendant; 29 Pressure/Retouch Flakes (4 quartzite, 14 chert, 3 KRF, 1 shale, 3 quartz); 16 Flakes (15 chert, 1 silicified Peat); six Shatter (5 chert, 1 quartzite); no bone materials were observed.

3) Douglas (EdNf-33)

Location: The site is located on the east side of the tributary on the first terrace above the floodplain. The site generally follows along the edge of a valley rim spur.

Site Character: The artifacts are clustered around the base of the slope. In this case, however, the conditions are open. The site is also in proximity to the large wintering configuration, Baker III.

Cultural Materials (Table 34): The assemblage has a high frequency of General Debitage, with silicified peat the preferred raw material at 40%; chert is found in almost equal proportions at 35%. The Chipped Stone Tool category is represented by only four types. It is not designated as to type, being somewhat intermediary between temporary campsite and winter designations.

QU'APPELLE RIVER SITES (Fig. 15)

Site Descriptions

I EeNe-12 - campsite (winter)
EdNe -7 - tipi ring site
EeNe -8 - tipi ring site
EdNe -9 - tipi ring site plus cairn
EeNe-10 - tipi ring site
EeNe-11 - campsite

EeNe-12 is located on the valley bottom of the Flying Creek near its confluence with the Qu'Appelle River. Private collections from this site indicate a chronology ranging from Oxbow to the Plains side-notched point types (Arthur et al 1975:46). EeNe-7,8,9,10 are tipi rings sites situated on an upland promotory, which gives an undisturbed view of Flying Creek, the Qu'Appelle, and Last Mountain Lake Valleys (Arthur et al 1975:48-52).

TABLE 33: LITHIC ARTIFACT CLASSIFICATION: WASCANA TRAILS II (EgNf-36)

					LITHIC TYPE DISTRIBUTION										
CHIPPED STONE INDUSTRY				FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE															
Flakes and Fragment				35	4	15	10	2	2		1		1		
Shatter Flakes & Blocks				6		2	1	3							
Cores and Fragments				2			1	1							
TOTAL				43	4	17	12	6	2		1		1		43
TOOLS															
SERIES	CLASS	SUBCLASS	Type												
BIFACIAL	POINTED	NOTCHED	Plains/Prairie												
			Avonlea												
			Besant	1					1						
			Pelican Lake												
			McK/Dun/Han[4]												
		UNNOTCHED	Preform												
		FRAG		1					1						
	TOTAL			2					2						
	LATERAL	LARGE	Thick												
			Thin												
		SMALL	Thick	1			1								
			Thin												
			Preform	1			1								
		FRAG													
	TOTAL			2			2								
	TUBULAR														
TOTAL				4			2		2						4
UNIFACIAL POINTED															
	LATERAL	LARGE													
		SMALL	Thick	1					1						
			Thin												
		FRAG													
	TOTAL			1					1						
	TUBULAR	PERFORATOR		1					1						
	TRANSVERSE	LARGE													
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL														
TOTAL				2					2						2
TOTAL				6											6

COBBLE STONE INDUSTRY			DEBITS[5]	TOOLS		DEBITS	TOOLS
SERIES	CLASS	Type					
COBBLE	UNMODIFIED						
	SPLIT						
	CORE						
		Simple					
		Complex					
		End					
SPALL	SURFACE						
	END						
	LATERAL						
	SECONDARY DEC[6]		1		1	—	
	FRAGMENTS						
TOTAL			1		1	1	

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 34: LITHIC ARTIFACT CLASSIFICATION: DOUGLAS (EgNf-33)

LITHIC TYPE DISTRIBUTION

CHIPPED STONE INDUSTRY	FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
GENERAL DEBITAGE												
Pressure/Retouch	6		2	2		2						—
Flakes and Fragment	44	1	21	17	1	1	3					
Shatter Flakes & Blocks	18		5	4	3	4	2					
Cores and Fragments	1			1								
TOTAL	69	1	28	24	4	7	5					69

TOOLS

SERIES	CLASS	SUBCLASS	Type	FREQUENCY	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	TOTAL
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie												
			Avonlea												
			Besant												
			Pelican Lake												
			McK/Dun/Han[4]	1			1								
		UNNOTCHED	Preform												
		FRAG													
	TOTAL			1			1								
	TUBULAR														
TOTAL				1											1
UNIFACIAL POINTED															
	LATERAL	*LARGE*		1			1								
		SMALL	Thick	1			1								
			Thin	1					1						
		FRAG													
	TOTAL			3			2		1						
	TUBULAR	*INCISER*													
	TRANSVERSE	*LARGE*													
		SMALL	Thick												
			Thin												
		FRAG													
	TOTAL														
TOTAL				3			2		1						3
TOTAL															4

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	D[5]EBIT	TOOLS	QUARTZITE	[1]SILIC PEAT	CHERT	QUARTZ	[2]KRF	[3]SILIC WOOD	SHALE	OBSIDIAN	CHALCEDONY	OTHER	DEBIT	TOOLS
COBBLE	UNMODIFIED															
	SPLIT															
	CORE															
		Simple														
		Complex														
		End														
SPALL	SURFACE		1	1	1									1	—	
	END															
	LATERAL															
	SECONDARY DEC[6]		1		1										—	
	FRAGMENTS		1		1										—	
TOTAL			3	1	2									1	3	1

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3. Silicified Wood 4. McKean/Duncan/Hanna 5. Debitage 6. Decortication

TABLE 35: ARTIFACT TYPE DISTRIBUTION: BY SITE: WASCANA CREEK

				CAMPSITES									
				TEMPORARY					OBSERVATION POST				
				1	2	3	4	5	1	2	3	4	5
CHIPPED STONE INDUSTRY				EcNe-10	VALLEY RANCH II	GRANT III	NORONA	WASCANA TRAILS I	EcNe-11	GRANT II	BEATTY II	BAKER IV	WASCANA TRAILS III
GENERAL DEBITAGE													
Pressure/Retouch													
Flakes and Fragment				X	X	X	X	X		X	X	X	X
Shatter Flakes & Blocks					X	X		X	X	X	X	X	X
Cores and Fragments				X	X	X			X			X	X
TOTAL													
TOOLS													
SERIES	CLASS	*SUBCLASS*	Type										
BIFACIAL	POINTED	*NOTCHED*	Plains/Prairie										
			Avonlea										
			Besant										
			Pelican Lake										
			McK/Dun/Han*										
		UNNOTCHED	Preform										
		FRAG											
	TOTAL												
	LATERAL	*LARGE*	Thick										
			Thin										
		SMALL	Thick										
			Thin										
			Preform							X			
		FRAG		X		X							
	TOTAL												
	TUBULAR												
TOTAL													
UNIFACIAL POINTED													
	LATERAL	*LARGE*								X			
		SMALL	Thick		X			X				X	
			Thin										
		FRAG		X		X							
	TOTAL												
	TUBULAR	*Inciser*											
	TRANSVERSE	*Large*											
		Small	Thick			X							
			Thin		X								
		Frag		X									
FCR				X	X		X		X	X	X	X	X
BONE				X	X		X		X	X	X	X	
COBBLE STONE INDUSTRY													
SERIES	CLASS	Type											
COBBLE	UNMODIFIED												
	CORE												
		Simple											
		Complex				X		X			X		
		End					X						
SPALL	SURFACE							X				X	
	END				X								
	LATERAL												
	SECONDARY DEC*					X	X					X	
	FRAGMENTS				X								X
TOTAL													

ABBREVIATIONS:

1. Silicified Peat 2. Knife River Flint 3 Silicified Wood 4. McKean/Duncan/Hanna 5. Decortication

TABLE 35 cont: ARTIFACT TYPE DISTRIBUTION: WASCANA CREEK

CHIPPED STONE INDUSTRY

				CAMPSITES	WINTER										
				1	2	3	4	5	6	7	8	9	10	11	12
				MARTIN	EcNo-6	BAKER I	GILMORE II	EaNf-13	DUNLOP	BAKER IIIa	BAKER IIIb	SHERWOOD FOREST II	VALLEY RANCH I	GRANT I	GILMORE I
GENERAL DEBITAGE															
Pressure/Retouch						X	X	X		X	X	X	X		X
Flakes and Fragment				X		X	X	X	X	X	X	X	X	X	X
Shatter Flakes & Blocks				X		X	X	X	X	X	X	X	X	X	X
Cores and Fragments				X		X	X	X	X	X	X	X	X	X	X
TOOLS															
SERIES	CLASS	*SUBCLASS*	Type												
BIFACIAL	POINTED	*NOTCHED*	Other							X			X		
			Plains/Prairie		X			X		X			X		X
			Avonlea				X								
			Besant		X				X	X	X		X		
			Pelican Lake		X			X							
			McK/Dun/Han[1]												
			Lanceolate				X								
		UNNOTCHED	Preform				X			X	X				X
		FRAG		X										X	
	LATERAL	*LARGE*	Thick	X			X		X				X		X
			Thin								X		X		X
		SMALL	Thick		X	X	X			X	X		X	X	X
			Thin		X										X
			Preform						X				X	X	
		FRAG						X				X			
	TUBULAR											X			X
UNIFACIAL	POINTED						X	X							X
	LATERAL	*LARGE*		X								X		X	X
		SMALL	Thick	X	X		X	X	X	X		X		X	X
			Thin	X	X		X		X	X	X	X	X		X
	SPOKESHAVE	*FRAG*													
	FRAG					X									
	TUBULAR	*PERFORATOR*								X	X				
		INCISER					X								
	TRANSVERSE	*LARGE*		X	X					X	X		X		X
		SMALL	Thick				X			X			X		X
			Thin				X	X	X	X			X	X	X
FCR				X	X	X	X	X	X	X	X	X	X	X	X
BONE				X	X	X	X	X	X	X	X	X	X	X	X
SHELL															
CERAMICS						X	X	X		X	X	X	X	X	X

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	1	2	3	4	5	6	7	8	9	10	11	12
COBBLE	UNMODIFIED	Hammerstone			X		X		X	X				X
	GROUND	Maul		X			X	X	X					X
		Pestle		X										
	CORE													
		Simple									X			X
		Complex				X		X			X			X
		End	X		X			X	X					X
SPALL	SURFACE		X	X		X	X	X	X	X	X	X		X
	END						X	X				X		X
	SECONDARY DEC[2]				X			X	X	X		X		X
	FRAGMENTS												X	

ABBREVIATIONS:

1. McKean/Duncan/Hanna 2. Decortication

TABLE 35 cont: ARTIFACT TYPE DISTRIBUTION: WASCANA CREEK

CHIPPED STONE INDUSTRY

				CAMPSITES				
				NON-DESIGNATED			SPRING	
				1	2	3	1	2
				WASCANA TRAILS II	EcNe-1	DOUGLAS	BAKER II	EdNf-13
GENERAL DEBITAGE								
Pressure/Retouch					X		X	
Flakes and Fragment					X		X	
Shatter Flakes & Blocks					X		X	
Cores and Fragments							X	
TOOLS								
SERIES	CLASS	*SUBCLASS*	Type					
BIFACIAL	POINTED	*NOTCHED*	Historic		X			
			Plains/Prairie				X	
			Avonlea					
			Besant	X				X
			Pelican Lake					
			McK/Dun/Han[1]			X		
			Lanceolate					
		UNNOTCHED	Preform				X	
		FRAG						
	LATERAL	*LARGE*	Thick				X	
			Thin					
		SMALL	Thick	X	X			
			Thin				X	
			Preform	X				
		FRAG						
	TUBULAR							
UNIFACIAL	POINTED							
	LATERAL	*LARGE*				X	X	
		SMALL	Thick	X		X	X	X
			Thin			X	X	X
	SPOKESHAVE	*FRAG*					X	
	FRAG							
	TUBULAR	*PERFORATOR*		X				
		INCISER	Thick					
	TRANSVERSE	*LARGE*						
		SMALL	Thick				X	
			Thin				X	X
FCR					X	X	X	X
BONE					X	X	X	X
SHELL							X	
CERAMICS								X

COBBLE STONE INDUSTRY

SERIES	CLASS	Type	1	2	3	1	2
COBBLE	UNMODIFIED	Hammerstone					
	GROUND	Maul					
		Pestle					
	CORE						
		Simple					
		Complex					
		End					
SPALL	SURFACE				X	X	
	END					X	
	SECONDARY DEC[3]		X		X	X	
	FRAGMENTS						

ABBREVIATIONS:

1. McKean/Duncan/Hanna 3. Decortication

On these sites a minimum of 29 tipi rings were distinguished. A cairn was also associated with EeNe-9. Two springs, one permanent, were found in a coulee to the immediate west of EeNe-10. The above four tipi sites may be the associated spring campsites of the winter camp (EeNe-12) on the floodplain. EeNe-11 was designated as a campsite.

2. EeNe-1 - campsite (winter)
   EeNe-25 - cairn
   EeNe-40 - kill site
   EeNe -3 - campsite
   EeNe-26 - campsite

EeNe-1 is located at the confluence of the Qu'appelle River, and Last Mountain Creek . The confluence occurs in close proximity to the valley slope, which provides more sheltered conditions. The artifact assemblage of cultural materials contains lithics, ceramics, and bone tools (Arthur et al 1975:138). The latter categories types tend to be associated with a winter camp. EeNe-3 and EeNe-26 are both located on the uplands, and may have been tipi ring sites. EeNe-25 consists of three rock cairns on a slump block near valley bottom. EeNe-40 is a kill site located on the bottom of a coulee.

3. EeNe-33 - tipi ring site
   EeNe-32 - camp site
   EeNe-30 - tipi ring site
   EeNe-31 - campsite

The sites are all located in a large coulee running into the Qu'Appelle Valley from the northwest (Fig. 15). Springs occur in the coulee, as well as an intermittent stream bed (Arthur et al 1975:53-56). EeNe-30 and 33 are located on terraces along the coulee bottom; and combined they have a minimum of 10 tipi rings. EeNe-32 is a campsite which is also located in the coulee bottom. EeNe-31 is a campsite on the uplands on the east side of the coulee.

4. EeNe-27 - tipi ring site
   EeNe-28 - tipi ring site
   EeNe -5 - tipi ring site
   EeNe-39 - kill site
   EeNe-42 - kill site

All the above sites are in proximity to a coulee containing several active springs . EeNe-5,27,28 are tipi ring sites on the prairie uplands that are clustered around the coulee. Together the sites represent a minimum of 56 tipi rings; some cairns are also associated with EeNe-27. EeNe-39 is a kill site located at the bottom of the coulee; while EeNe-42 is a kill site located at the bottom of a small break in the valley wall.

5. EeNd -6 - tipi ring site
   EeNd -7 - tipi ring site
   EeNd -8 - cairns
   EeNd -9 - tipi ring site
   EeNd-10 - cairn
   EeNd-34 - tipi ring site

The sites on the uplands, are directly above a former water channel running parallel to the base of the valley slope (Arthur et al 1975:63).

6. EeNe-34 - kill site
   EeNe-35 - camp site

EeNe-34 is located in a coulee running into the Qu'Appelle Valley from the north, which contains a spring runoff cut (Arthur et al. 1975:56). EeNe-35 is found on the uplands in a cultivated field, and probably was a tipi ring site before cultivation. Lithic debitage, i.e., flakes and fragments, and tools, and bone fragments, were recovered from this site.

APPENDIX III

ARTIFACT CLASSIFICATION SYSTEM

THE CHIPPED STONE INDUSTRY

The Chipped Stone Industry consists of tools made primarily on flakes. The classification was first formulated during my analyses of the Garratt site, a winter campsite on the floodplain of the Moose Jaw River in the Qu'Appelle Valley Basin of southern Saskatchewan (Morgan 1979). Some modifications of this original classificatory system were required to accommodate the artifact variations that were observed in this more comprehensive study.

Two series were established on the basis of whether the artifact margin was unifacially or bifacially worked. These two series are further subdivided into classes on the basis of the placement of the "retouched" edge or area in relation to the longitudinal axis of the artifact. This subdivision is necessary, as the functional edge is not always the retouched edge. Retouch is sometimes used to blunt the back edge of the tool. If more than one edge is retouched, and there is positional conflict in relation to the longitudinal axis, then factors like secondary retouch (wear patterns or reworking of the tool) become important considerations in determining the class placement of the artifact. Each class in turn is divided into subclasses, or directly into type.

(A) GENERAL DEBITAGE

This group includes the various forms of detritus, i.e., retouch flakes, shatter, and cores that are created during the construction of tools. It also includes flakes with the potential for modification into the various tool types associated with the Chipped Stone Industry.

(B) TOOLS

BIFACIAL SERIES

CLASS - POINTED

Following White et al. (1963:32), the morphological class is defined by retouch along the lateral edges converging at one point along the longitudinal axis . This class includes artifacts defined commonly as projectile points. MacDonald (1968) postulates that "... bifacial tools such as knives, drills, and points, were designed primarily for piercing, tearing, or penetrating purposes ..." (1968:109). More specifically, he assigns both killing and butchering functions to projectile points. This interpretation is no doubt true for the larger, heavier, spear points of the Early Plains Indian Period. The later notched projectile points are small, making them ineffective in most butchering activities, particularly dismemberment processes. Notching would also weaken the point, particularly for activities that require strength as well as sharpness of tool.

The projectile point styles will be discussed within the chronological sequence defined by Dyck (1983). The sequence of point types seen on my survey, and observed in private collections from the area ranges from the Early Plains Indian Period, for which Dyck (1983) gives an initiation date of 10,500 B.P., to the historic period. Points from the Early Plains Indian period were infrequently encountered, and only in surface collections.

Early Plains Indian Period (10,500 B.P. to 8000 B.P)

The period is distinguished by spear points representing three major styles: (1) lanceolate fluted or basally thinned; (2) lanceolate straight and rounded base; and (3) lanceolate stemmed (Dyck 1983:73).

SUBCLASS - LANCEOLATE

Type - The specimen may be an Agate Basin base (Plate 14,p) recovered from an upland

site (EdNf-5).
Two complete specimens from this time period (Plate 18:o;EdNf-5) were also recovered, but were not classified to type.

Middle Plains Indian Period (7700 B.P. to 1850 B.P.) (Dyck 1983:87)

SUBCLASS - NOTCHED

Type - Mummy Cave (7700 to 4700 B.P.) (Plate 14:n,EdNf-5).

This type represents the first side-notched projectile points, supposedly tips for atlatl darts (Dyck 1983:92).

Type - Oxbow (4700 to 3050 B.P.) (Plate 14:m,EdNf-40)
Type - McKean/Duncan/Hanna (4150 to 3100 B.P.) (Plate 14:l,EdNf-2)
Type - Pelican Lake (3300 to 1850 B.P.) (Plate 14:k,EdNf-3)

Late Plains Indian Period (2000 B.P. to 170 B.P.) (Dyck 1983:110)

The period is distinguished by the appearance of side-notched arrow points.

Type - Besant (2000 to 1150 B.P.) (Plate 14:j,EdNf-5;i,EdNf-36;n,EdNf-40).
Type - Avonlea (1750 to 1150 B.P.) (Plate 14:f,EdNf-5)
Type - Plains/Prairie (1150 to 170 B.P.) (Plate 14:b,d,EdNf-11;c,EdNf-5;e,EdNf-26)
Type - Historic (Plate 14:a,EdNf-5)

SUBCLASS - UNNOTCHED (Plate 14:g,EdNf-22)

The unnotched biface form has often been referred to as an unfinished version of the associated notched type. Forbis (1960), upon observing the similarities between the unnotched form and the Avonlea type point, concluded that they were unnotched variants of the component notched type (1960:138). MacNeish (1958:103) has suggested that the unnotched form can be directly used as a projectile point. I have suggested that the notched arrow point is a specialized derivative (specific for penetration activities) of an unnotched, more generalized form which has alternative functional applications, including use as a projectile (Morgan 1979:286). A large frequency of both forms at the Garratt site allowed me to carry out a comprehensive comparative analysis. In the Plains/Praire side-notched component (level 2), the unnotched form made up 27.6% of the identifiable sample (29); in the Avonlea component (level 6), the unnotched form represented 60% of the Avonlea point sample (48). In the Avonlea component 48% of the unnotched forms also exhibited diagonal breakage. I concluded that the unnotched form could easily be slotted into a handle and used as a cutting tool in activities that required a sharpness of edge rather than durability (1979:342). It would be effective in activities that required both piercing and cutting, such as the cutting of skin fabrics or final stages of butchering. Diagonal breakage would be a common result of these activities.

Use patterns were not discerned; however, durability would not be an attribute of these artifact types, so that breakage most likely occurred before use patterns became discernable.

CLASS - LATERAL BIFACES

The minimal requirement is the presence of marginal retouch along one of the lateral edges. Positioning of the retouched edge in relation to the longitudinal axis is influenced by the shape of the preform flake. It can be parallel to the longitudinal axis (these artifacts are usually ovate or rectangular in form), or it can be oblique to the longitudinal axis (these artifacts are triangular in form) (White et al 1963:33).

SUBCLASS - LARGE

One of the dimensions must be greater than 60 mm.

Type - Thick (Plate 15:a,EdNf-22).

Dimensions: L=77-126 mm, W=30-56 mm, T=3-19 mm. Tool modification ranges from partial to complete percussion flaking of both surfaces, resulting in lateral sides that are sinuous in both outline and cross - section. Marginal retouch, if present, is generally irregular and discontinuous. In outline the tools are predominantly ovate; i.e., generally pointed at one end, rounded at the other. Bases are often thinned, possibly for hafting. On several specimens the point is quite blunt, negating penetration activities.

Use patterns when discerned were blunting and slight crushing along the lateral edge. Similar tools at Mummy Cave were observed to have battered sinuous edges (Husted 1978:54).

As to function, the sinuous edge would facilitate simultaneous chopping/cutting activities. More specifically, the tool would be very effective in the initial stages of butchering; dismemberment, separation of meat from skeletal elements. It would also be highly effective in reducing fibrous vegetal products or dried meat.

Type - Thin (Plate 15:b,EdNf-5)

The specimens are no greater than 12 mm in thickness. Dimensions: L=64-70 mm, W= 24-37 mm, T=7-11 mm.

These tools have well-executed flaking or both surfaces, and marginal retouch along both lateral sides, resulting in edges that are regular in outline and straight in cross-section. The tools are mostly ovate with sharp tips. Bases are frequently thinned to facilitate hafting.

It appears that sharpness of edge rather then strength of tool was the primary focus during the fabrication process. These tools have the joint functional attributes of piercing and cutting which are essential in many butchering processes such as cutting the skin and loosening it from the carcass. Also flesh is a slippery, yielding surface which is most efficiently butchered with a piercing, cutting motion. These tools are thus best for the more advanced stages of butchering. For example, Kehoe's Blackfoot informant stated that:The man'o [roast] was separated from the sinew in it by slicing it along the sinew and pulling it apart. The meat was excellent for drying and putting it up to dry involved slicing it in strips not quite cut enough (apart) until after it was removed from the drying rack" (in Kehoe 1967:70).

SUBCLASS - SMALL

Type - Thick (Plate 15:c,EdNf-41)

Dimensions: L=33-51 mm, W=24-44 mm, T=9-14 mm.

This grouping has a high range of variability in both form and the degree of modification. An ovate outline is most common, followed by triangular and to a lesser degree rectangular and circular outlines. Modification ranges from the minimum, i.e., marginal retouch, which is often irregular and discontinuous, to overall crude percussion flaking on both surfaces. On these latter tools marginal retouch may be present on one or both lateral edges. Basal thinning is sometimes present, possibly to facilitate hafting.

Use patterns include dulling and/or crushing of the lateral edge, often in the tip area of ovate or triangular specimens. Tips are usually more rounded than sharp. The sinuous working edge suggests predominate use in chopping/cutting activities such as the reduction of vegetal and animal products.

These tools have a compact durable cutting edge which enables them to perform a variety of functions; i.e, multipurpose. They would also be highly efficient in working more rigid raw materials such as wood and bone.

Type - Thin (Plate 15:d,EdNf-3)

The artifacts are no greater than 6 mm in thickness.

Dimensions: L=24-47 mm, W=14-29 mm, T=3-6 mm.

In this category a wide range of variability in both form and the degree of modification is also present. A triangular outline predominates, followed in diminishing frequency by ovate, rectangular, and circular outlines. Again, modification ranges from marginal retouch, which is often discontinuous, to well-executed, generally overall flaking on both surfaces. Marginal retouch may be present on one or both lateral edges.

Use patterns, when discerned, included smoothing in the tip area or slight crushing along the working edge. These tools are less durable then the thicker versions, so that only moderate force can be applied in their use; however, lack of durability is balanced by a sharp working edge; and on the ovate and triangular specimens, the frequent presence of a sharp tip. These tools are thus highly suited for piercing/cutting activities such as the final stages of butchering when sharpness of edge is the most essential prerequisite.

SUBCLASS - PREFORMS (Plate 15:e,EdNf-5)

Dimensions: L=35-54 mm, W=30-42 mm, T=9-25 mm
The predominate outline is circular, followed by ovate. All specimens are formed by rough percussion flaking, and have a highly irregular outline. Cortex is often found on the surfaces. These artifacts appear to be unfinished versions of bifacial tools.

CLASS - TUBULAR (Plate 15:f,EdNf-5;g,EdNe-6)

The retouched area is a "tubular area revolving parallel to the longitudinal axis" (White et al. 1963:33).

Dimensions: L+53-39 mm; W=15 mm; T=10-6 mm

Well executed overall flaking is generally present. The working end or tip is pointed and biconvex in cross-section. The base has been thinned to facilitate hafting.

The form of the working end is particularly suited for perforating yielding surfaces such as skins. A circular in cross-section of the point allows for a twisting motion during perforation, which would reduce the possibilities of tearing or stretching the skin.

UNIFACIAL SERIES

CLASS - POINTED (Plate 16:a,EdNf-22)

The retouched edge is located along the lateral edges, converging at a point along the longitudinal axis (White et al 1963:92).

Dimensions: L=24 mm; W=17-22 mm; T=3-7 mm

These tools are triangular, with retouch along both lateral edges, which converge to a sharp point. Flat or tabular flakes are most commonly utilized, followed by ridged. One pattern of modification frequently occurred: high-angle retouch along one lateral edge, and low-angle retouch or sheer retouch along the other edge.

The flake morphology suggests that these tools were fabricated for activities that require some degree of penetration. The edge retouch implies multipurpose functions, both scraping and cutting activities.

CLASS - LATERAL

The criteria used in the classification of lateral bifaces are applicable to this class, the difference being that retouch is unifacial, and tends to be restricted to marginal retouch. This class includes artifacts that are functionally defined as sidescrapers.

SUBCLASS - LARGE (Plate 16:b,EdNf-5)

One dimension must be greater than 44 mm.
Dimensions: L=46-58 mm; W=20-46 mm; T=7-17 mm.

In this category modification is restricted to marginal retouch along the dorsal surface. The predominate outlines are rectangular and triangular, and infrequently ovate.

One variation is mostly constructed on marginally ridged flakes, giving one naturally thick high-angle edge and one markedly thinner edge. Retouch is generally restricted to one lateral edge, most often the thinner one. Retouch is high-angled and not well-executed.

A second variation is constructed on flat or tabular flakes (Plate 16,b). Marginal retouch is present along one or both lateral edges. MacDonald (1968:109-110) states that, "Unifacial tools are designed for surface modification without penetration", and were used primarily for scraping and shaving functions. The large unifaces with their high-angle edges would certainly fit this functional definition; also, being large and durable, they would be efficient tools on a wide range of surfaces, both yielding (skins) and unyielding (bone and wood). Use patterns, including both crushing and smoothing, certainly suggest contact with both types of surfaces. As to the types of functions, MacDonald (1968:109-110) suggests that unifacial tools are used for processing raw materials (animal and vegetable), for clothing and shelter; while Husted (1978:30) assigns these tools to hide-working activities.

SUBCLASS - SMALL

The tools are divided into type on the basis of variations in thickness, with the division point arbitrarily set at 6 mm.

Type - Thick (Plate 16:c,EdNf-5)
Dimensions: L=29-44 mm, W=19-29 mm, T=7-12 mm.

These tools are constructed on ridged flakes, with marginal ridges the most common. A rectangular outline is the most frequent form, followed by triangular. Ovate or circular outlines are infrequent. The most common modification pattern is marginal, generally high-angle, retouch on one lateral edge along either the dorsal or ventral surface. In durability, the small thick tools would approach the large forms, suggesting many similar functions. However, their smaller size, with a corresponding reduction in the scraping area, would negate efficient use on large surfaces.

Type - Thin (Plate 16:d,EdNf-5;e,EdNf-41;f,EdNf-3)
Dimensions: L=22-43 mm, W=14-29 mm, T=2.5-6 mm

Modification of these tools is restricted to marginal retouch. The outline of the preform flake is variable, with rectangular and triangular forms being the most common; ovate and crescentic occur less frequently.

In one variation the tools are made mostly on marginally ridged flakes. The flake thus has one thin lateral edge, and one thick high-angle edge. Marginal retouch is along one lateral edge, generally the thin edge. The thick marginal ridge provides strength to the tool.

Another variation is also fabricated on ridged flakes, but placement of ridges is more varied. Marginal ridges are still the most common, but flakes with medial and diagonal ridges are also used. Modification, which is present along both lateral edges, exhibits considerable variability: both edges with fine high-angle retouch; one edge with high-angle retouch and the other with low-angle retouch (Plate 16,d); and both lateral edges with sheer retouch.

Wear patterns that were observed include smoothing, polish, and dulling; such patterns are consistent with contact with a yielding surface such as skins. Because of the fragile nature of these tools, another common wear pattern was irregular chipping of the working edge. Also attesting to their fragile nature is the high frequency of breakage. Short-term usability also contributed to the high frequency of these tools on sites.

The overwhelming majority of these tools functioned as cutting tools or to a lesser extent as piercing/cutting tools. One type of piercing/cutting tool was created by snapping the flake in the middle (Plate 16,f). According to MacDonald (1968:98), the angle of fracture is acute to the working edge, giving a sharp cutting corner.

Many of the flakes in this category have a natural serrated edge, which was often utilized in the unmodified state. As to cutting abilities, MacDonald (1968) notes that... "on a piece of tanned leather 3 mm thick, it was found that a thin flake with a slightly serrated edge was capable of slicing long stripes or thongs with almost the same efficiency as a razor blade" (1968:102). The thinner specimens in this category were also predominantly fabricated from Knife River Flint.

SUBCLASS - SPOKESHAVES (Plate 17:j,EdNf-22)

Dimensions: L=33-56 mm; W=25-44 mm; T=8-20 mm

The tools are generally irregular in outline, and modification is usually restricted to marginal retouch. A semicircular concavity, usually one, occupies a portion of the lateral edge; but up to two have been observed along one edge. The concave edge usually has high-angle retouch.

Use wear includes dulling and crushing, suggesting use against an unyielding surface. It has been suggested that tools of this nature are used to trim and smooth [wooden] shafts. (Husted 1978:30).

CLASS - TUBULAR

The general criteria used for tubular bifaces is applicable here. The class is subdivided into two types on the basis of possible functional attributes: perforations and incisers.

Type - Perforators (Plate 16:g,h,EdNf-5)

Dimensions: L=50-36 mm, W=25-13 mm, T=3.5-7 mm.

These tools are fabricated on flakes with medial or marginal ridges, the result being a triangular cross-section. Modification is restricted to marginal retouch. There is a general tendency for one lateral edge to exhibit fine uniform retouch, while the other lateral edge is generally serrated. Serration can be quite regular, suggesting shear retouch; or irregular and discontinuous, suggesting use.

One variation made on thin flakes has parallel sides with a rounded end (Plate 16,g), or there may be a slight tapering towards the end to give a more pointed tip. A blunt flat tip suggests that penetration is direct, with no twisting motion. These tools would be suited for the penetration of unyielding surfaces such as wood, as the flat edge would easily penetrate between the fibrous elements.

The second variation includes specimens which are slightly thicker with more pronounced ridges; definitely tools of a more durable nature. In outline they are triangular, tapering to a sharp point (Plate 16,h). Bases may be thinned or notched to facilitate hafting. Use patterns vary from pronounced crushing in the tip area to blunting or smoothing of the tip area. Again these appear to be multipurpose tools capable of cutting as well as penetration activities on yielding and/or unyielding surfaces.

Type - Incisers (Plate 16:i,k,EdNf-5;j,EdNe-22)

The working area of the tool is of insufficient length for most perforating activities. Modification of the tool is mostly marginal, often restricted to the tip area. There are two variations based on the thickness of the tool.

The first variation (Plate 16,i) is constructed on thick flakes ranging from 8-16 mm. Because the artifact body is thick and the tip section relatively short, in longitudinal profile the tip is steeply angled from the dorsal surface, and sharply tapered from the lateral edges. The result is a bulky tip of great durability, highly suitable for incising unyielding surfaces such as bone or wood. The only wear pattern discerned was a dulling or smoothing of the tip area.

The second variation (Plate 16,j,k) is constructed on thin flakes (3-5 mm), often with a fine ridge running centrally along the tip. Most specimens exhibit fine marginal retouch, in varying degrees, along both lateral edges. On several specimens the extreme tip area has been bifacially flaked so that the working area is biconvex in cross-section. Although the ridge offers some support to the tool, the thinness of the tip area (2-3 mm) negates most activities associated with unyielding surfaces. These tools would be particularly suited for incising yielding surfaces such as pottery. Some of the bifacially worked tips (Plate 16,k) could possibly be used for perforation activities, i.e., fine skins; however, depth of penetration would be highly limited.

CLASS - TRANSVERSE UNIFACES

The major retouch edge is transverse or perpendicular to the longitudinal axis (White et al 1963:32). The functional designation often used for this class is endscraper.

Type - Large (Plate 17:a,EdNf-2;b,EdNf-26)

One of the dimensions must be 40 mm or greater

Dimensions: L=40-67 mm; W=22-45 mm; T=9-19 mm.

Modification of tools ranges from a minimum of marginal retouch along the transverse edge to overall flaking of the dorsal surface, with marginal retouch along both lateral edges. All working edges are convex in outline. Modifications for hafting were rarely observed.

The variations were established based on the morphology of the working edge. On one variation (Plate 17,a) the transverse edge is sharply angled (60-90^0 range). Those approaching 90^0 are probably exhausted tools. Hinge scars are of common occurrence, with a tendency to be most pronounced and frequent at the apex of the working edge. Slight crushing is often an associated wear pattern. The other variation (Plate 17,b) has a low angle working edge (45^0 to 60^0) sloping back to a central point on the flake's dorsal surface; in outline it has almost a pyramidal form. The only use pattern discerned for this form is smoothing of the working edge. Wilmsen (1968:159) claims that different angle sizes are related to different functions. More specifically, he states that high-angle tools with a shattered working edge and chip scars extending along the dorsal surface were employed in the manufacture of wooden and bone implements. He also correlates acute edge angles with wear patterns of polish and high luster to activities such as hide preparation.

SUBCLASS - SMALL

Type - Thick (Plate 17:c,EdNf-5;d,EdNf-3)

Dimensions: L=12-36 mm, W=12-31 mm, T=7-12 mm

The frequency of tools with an unmodified dorsal surface as compared to those with a modified dorsal surface is about equal. Ridged flakes (Plate 4,c) were most commonly used, followed by cortex flakes; then flat or tabular ones. The majority of the tools have a convex working edge; however, straight edges were also observed. Marginal retouch is highly variable, ranging from complete absence to retouch along both lateral edges. Only a small frequency of tools had basal flakes removed to facilitate hafting, most often the thinner ones (7-8 mm). That many of these tools were hand-held is substantiated by the fact that several of the tools had smoothed and polished lateral edges. In terms of use patterns, this grouping conforms closely to that established for the large category. A high frequency of hinge scars and crushing tends to be associated with a high-angle working edge. Shay (1971:58) has added another dimension to this correlation; that is, thickness. He found that scrapers 6 mm or more thick tend to exhibit wear patterns of the above nature. On low-angle tools the tendency was for working edges to exhibit dulling or smoothing which is suggestive of use on an unyielding surfaces. Of the above two patterns the first was the most frequent.

In determining possible functions consideration must be given to the size of the scraping edge. Whether convex or straight, the extent of flat surface area that the tool is physically capable of being in direct contact with ranges from 5 mm to at most 12 mm, hardly suitable for scraping large surfaces such as most skins. Tools with a convex scraping edge would have the capability of scraping the inner concave surface of bone to facilitate removal of calcaneous tissue. Other activities could include removal of bark from green shafts, and/or smoothing of surface irregularities. These tools also would be effective in scraping vegetal products such as roots.

Type - Thin (Plate 17:e,EcNe-19;f,h,EdNf-5;g,EdNf-39;i,EdNf-3;j,EdNf-22)
Dimensions: L=14-33 mm, W=14-27 mm, T=3-6 mm.

In this category the number of tools with unmodified dorsal surfaces is significantly higher then those with a modified surface (Plate 17,e). Ridged flakes (Plate 17,i) are still the most commonly used, followed by cortex flakes (Plate 17,h,g), then tabular flakes.

The number of tools with basal modification for hafting purposes was about equal to those with no modification. Attempts were made to slot these tools into bone rib handles with openings ranging from 13-15 mm in width, 3-5 mm in thickness, and 20-24 mm in depth. Using specimens from site EdNf-5, 20 out of 27 thin complete specimens could be slotted into the handles; while only two out of 29 of the small thick specimens could be slotted into the handles.

A variation distinct for the thin category are tools 3 to 5 mm thick with wear patterns of smoothing and high gloss (Plate 17,i). Wear patterns of this nature are most often associated with hide preparation. The fragile nature of the tools and the restricted size of the scraping edge suggests that they would be rather ineffective in processing large or tough hides. Again, considering the use patterns and morphology, the tool could function as a spoon, being very effective in scooping marrow (raw or cooked) out of bones.

THE COBBLE STONE INDUSTRY

This classification system was first compiled during my archaeological study in 1982, along 258 km of pipeline right-of-way in southwestern Saskatchewan. Out of 32 sites that were impacted, 23 (mostly tipi ring sites) were excavated and surface-collected. The artifact assemblages were dominated by the Cobble Stone Industry, and were large enough that trends in tool types were discerned. In the Qu'Appelle study, the range of tool types in this industry is not as extensive or as abundant, so that the classificationn system was simplified.

These artifacts are categorized on the basis of descriptive attributes which include the natural morphology of the raw materials, and the nature and degree of modification resulting from human activities. The initial categories in this industry are debitage and tools. Debitage refers to the various forms of detritus, i.e., cores, core fragments, spalls and spall fragments, created during the construction of tools. However, both spalls and cores are often utilized as tools with no further modification. Therefore the criteria for specifically defining an artifact as a tool are evidence of use or retouch, which is usually marginal.

Since the morphological changes resulting from the construction of tools are almost negligible, the subdivisions within these two categories, with few exceptions, are basically the same. Two series were established: cobble and spall. The cobble series includes split cobbles and cores. Spalls, with the exception of those classified as decortication, are the initial portions struck from a core. On all spalls cortex is present in varying degrees.

DEBITAGE
COBBLE SERIES

CLASS - SPLIT COBBLE
A split cobble is essentially a halved cobble.
CLASS - CORE
According to White et al (1963:6), "the term core refers to a block or nodule from which flakes are detached".
Type - Simple
Only one spall is removed from the core.
Type - Complex
Two or more spalls/flakes are removed from the core.

Type - End

Two or more spalls/flakes are removed; however, modification is restricted to one end of the core. Essentially this is a type of complex core, but its high representation at the sites required that it be given a separate category.

SPALL SERIES

The criteria for differentiating the following artifacts is derived partly from Quigg's classification of pebble groups (1978:23).

CLASS - SURFACE

This group includes those spalls removed from the outer, generally flat surfaces of the cobbles. These spalls have two surfaces: the outer, which is entirely covered by cortex; and the inner, which is also referred to as the split surface. Since they are the initial portions struck from a core, they would be called primary decortication spalls (White et.al 1963:5).

CLASS -END

These spalls were removed from the ends of the cobbles. The separation is generally transverse to the longitudinal axis of the cobble. Artifacts of this nature have one split (inner) and two cortex surfaces.

CLASS- SECONDARY DECORTICATION

The term "secondary decortication" refers to the fact that cortex covers only a part of the outer surface (White et al 1963:5).

TOOLS
COBBLE SERIES

CLASS - UNMODIFIED (Plate 18:a,EdNf-41)

This group includes artifacts that have had no modification prior to use. One variation is an unmodified cobble which shows signs of crushing at both ends. MacDonald (1968) designates artifacts of this type as hammerstones, and suggests they were used as crushers for reducing a variety of material. Kehoe claims they were "... stone-strikers used in dressing nodules...." (1973:111).

CLASS - GROUND (Plate 19:a,EdNf-40;b,EdNf-29)

This class contains tools that have been fabricated by pecking. One variation is a cobble with a pecked groove at mid-point around the whole circumference. This artifact, which is usually referred to as a grooved maul, has extensive crushing present on both ends. The wear patterns suggest usages similar to those inferred for hammerstones. Pestles (Plate 19,b) are also included in this category.

CLASS - CORE (Plate 18:b,EcNe-6)

Type - Simple

A shallow spall is removed from the end of the cobble. The edge on this end exhibited several kinds of use patterns: extensive crushing, or a smoothed and rounded edge. Eyman (1968:26) suggests that the latter wear patterns are associated with the fleshing of raw hides. A cobble size would be needed for efficient scraping of a large bison hide.

Type - End (Plate 18,b)

Tools of this nature usually exhibit massive crushing or battering along the working edge. These tools are most often identified as choppers, and are used in activities such as primary butchering and initial lithic reduction.

SPALL SERIES

CLASS - SURFACE (Plate 20:a,EdNf-32;b,EcNe-6)

The tools in this category generally conform to attributes established by Eyman 1968 for ***teshoa***. She states

> It was frequently made from quartzite, but other granular stones were used. It is a split or spall struck from a cobblestone. Its edge is thin and acute. The cutting edge is formed by the intersection of a split surface with the rind of a cobble (1968:10).

Eyman (1968:10) notes that teshoa are used first without retouch; but when the edge is remade, retouch is on the split surface so that a new edge is formed in the rind.

An example of the above retouch pattern can be seen in Plate 20, specimen (a). Eyman has observed that a rounded or smoothed wear facet on the working edge is the most conspicuous use mark on Gull Lake teshoa. She associates the tool's use with a yielding surface, possibly in the defleshing and cleaning of fresh skins (in Kehoe 1973:83). Other uses for teshoa suggested by Eyman include slitting knives in skinnning and butchering; chipping hammers in resharpening choppers or other teshoa; paring knives in cutting through muscles (in Kehoe 1973:83).

However, the most frequent retouch pattern on the spall tools recovered from the Qu'Appelle survey is cortex retouch (Plate 20,b). Eyman refers to cortex retouch as inverse resharpening, and suggests it alters teshoa into choppers (1968:17). However, she states that at all sites inversed retouched specimens are rare and their significance is obscure.

Cortex retouch was also the main pattern observed on the 1982 pipeline survey. I have suggested that in many instances cortex-retouch is a deliberate modification for a functional purpose, rather than a resharpening process. Retouch on the cortex surface provides an uneven serrated working edge. In vegetal processing (fibrous roots), a slightly serrated edge facilitates cutting against the grain. Reid, in discussing Psoralea esculenta, notes that various Plains groups cut the roots into slices for drying (1977:322). Retouch on the cortex surface also tends to increase the angle of the working edge. With the addition of the morphological characteristic of a serrated edge, the result is a tool that can also serve effectively as a scraper. A multi-purpose tool of this nature is again very effective in processing roots that must be scraped as well as cut. Hind (1971) observed that, "Many bushels [prairie turnip] had been collected by squaws and children, and when we came to their tents they were employed in peeling the roots, cutting them into shreds and drying them in the sun" (1971:Vol.I:319). According to Kennedy:

> Turnips were peeled and eaten raw or sliced and cooked into a soup, with pieces of fat added to give a rich flavour. The bulk of the turnips gathered were peeled, sliced, and spread out on hides on the ground and dried (1961:82).

CLASS - SECONDARY DECORTICATION (Plate 20:c,EdNf-40)

On an edge which has both a cortex and split surface, unifacial marginal retouch may be present on one or the other side . Unifacial retouch may also be present along an edge with two split surfaces (Plate 20,c). Use patterns are the same as for the surface spall, suggesting similar functions.